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NOTICE

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HORSESICKNESS INOCULATION.

HORSESICKNESS Inoculation. Vaccine for the inoculation of horses and mules of any age against horsesickness will be issued from now onwards until the end of November at a cost of 6s. per dose, post free.

Immunity does not reach its height until some months after inoculation, and owners are therefore urged not to defer inoculation until the end of the season.

The vaccine must be used within seven (7) days of its despatch from the Laboratory, and will be issued direct to applicants, who will be required to do or arrange for the inoculation themselves.

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Price: 6s. per dose.

Closing date for applications: 30th November.

Inoculate now.

Use within one week of its issue.

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Notes and Comments

COTTON AND EELWORMS: A CORRECTION.

In the article "Alternative Green Manure Crops," published in the "Rhodesia Agricultural Journal," November-December, 1947, and reprinted as Bulletin No. 1422, in the penultimate paragraph cotton is included as one of the field crops susceptible to eelworm. This is not correct as far as Southern Rhodesia is concerned, since although this crop is listed by the United States Department of Agriculture as being susceptible, it was found in trials carried out at the Tobacco Research Station, Trelawney, by Jack and confirmed by Mitchell that the strain of cotton currently grown in the Colony, namely 9L34, is highly resistant to nematode and can be strongly recommended in a rotation with susceptible crops such as tobacco and potatoes.

EXTRACTS FROM EAST MALLING RESEARCH STATION ANNUAL REPORT, 1946.

1946 brought no improvement in fruit farming operations as far as the weather was concerned and the result was that generally speaking yields were lighter and the size of fruit smaller, due no doubt to continued lack of sun.

There were no serious attacks by diseases or pests in the apple orchards. Apples matured at end of July.

A heavy drop of young fruits in July, common in Cox's Orange Pippin, was largely controlled by spraying with a 10 part per million spray of L—naphthalene—acetic acid on July 1st. The application of the spray should be timed so that its effective period covers the time when the drop is likely to be most severe —usually from ten days to one month before the picking date.

Experiments were also carried out on suspected boron deficiency in apples. The main symptom of boron deficiency in apple is a "corkiness" of the flesh of the apple. Although boron deficiency has caused serious economic loss in many overseas countries it has not been recorded in Britain. Treatments given were:—

(1) Boric acid (0.1 per cent.).

(2) Boric acid (0.1 per cent.) + Potassium sulphate (0.5 per cent.) + Urea (0.25 per cent.).

(3) Potassium Phosphate (0.5 per cent.) + Urea (0.25 per cent.)

(4) Not injected.

As a result of the experiments it is suggested tentatively that this "boron" deficiency belongs to the "cork" class and that mild boron deficiency may occur in British apple trees.

The crop of sweet cherries was the heaviest yet recorded and the quality was good.

The strawberry season was delayed and picking did not commence till 14th June.

In Scotland raspberries and strawberries are grown commercially on a very extensive scale, but virus diseases have caused such degeneration during the past years that the industry has been seriously threatened. It has been found that there are at least two distinct severe yellow edge diseases each caused by not less than two viruses, one of which, the persistent yellow edge virus is common to both: also mild and severe crinkle viruses are also constituents of the two yellow edge diseases, crinkle thus being shown to be related to and included in yellow edge.

Raspberry canes were infected with cane blight and had to be sprayed with D.D.T.

The potato crop suffered from blight, but spraying with 5 per cent. sulphuric acid before lifting prevented the spores from reaching the tubers. In addition the crop was planted late so that a yield of only 8 tons per acre of Majestic potatoes was realised.

The wheat and barley crops were good, but owing to the bad harvest season the oats were almost a total failure as the repeated turnings, which were necessary to try to dry the crop, resulted in a heavy loss of grain. Weather conditions also retarded the routine spray programme.

Preliminary experiments were carried out on the physiological effect of trace elements. Lateral leaflets of potatoes showing evidence of manganese deficiency were injected with an aequeous solution of manganese sulphate. The result was an increased assimilation rate in comparison with corresponding leaflets on the other side of the leaf. The work is being done by members of the staff of the Research Institute of Plant Physiology working in collaboration with the Biochemistry Section.

Experiments are continuing on the effect of D.D.T. on beneficial, predaceous and parasitic insects associated with fruit and also on the correct timing of D.D.T. dusts and sprays in relation to its effect on beneficial insects.

In the Plant Protective Chemistry Section work has continued on methods of analysis of pest control products. Tests have been carried out on the possibility of the formation of phosgene from D.D.T. in combination with other pest or disease control materials. Only vigorous oxidation by sulphuric acid-dichromate produced phosgene from D.D.T., but no phosgene was produced from the ethylene compound.

Bradbourne Manor with its 200 acre farm was purchased for the Research Station in 1938 and has yielded valuable land for experimental fruit growing. The sections dealt with were the Churchfield and Larkfield plantations, where soil surveys were carried out.

Fruit Growing Possibilities of the Eastern Districts of Southern Rhodesia

By C. N. HAYTER, F.Inst.P.A. (S.A.), Government Horticulturist.

A BRIEF DESCRIPTION OF SOME IMPORTANT POINTS.

(Written at the request of the Committee of the Eastern Districts Regional Development and Publicity Association and published with their kind consent.)

Southern Rhodesia should and can be a large fruit growing country, plantings of earlier days have given us much information to indicate the possibilities that exist in this direction, and it is safe to say that with the exception of orange growing, only the fringe of fruit farming has so far been attempted. In no part of the Colony are conditions so generally favourable to fruit culture as in the Eastern Districts.

Best Fruit Country. Commencing in a north-easterly direction at Inyanga and spreading to Rusapi, this tract of country extends southerly to Umtali, Melsetter and beyond Chipinga, a distance of around 200 miles which runs parallel to the Portuguese East African border. Here we have fruit country of the best. Rhodes's foresight in choosing part of the Rhodes Inyanga Estate at 6,000 ft. altitude for temperate fruit growing has proved so successful that the growing of apples, pears, plums, apricots and peaches has now extended well beyond, for a radius of several miles.*

Taking a quick trip through the Eastern Districts one leaves Inyanga and travels in a southerly direction for about 50 miles and passes through Odzani. A few miles off the road some promising mixed orchards have been planted. At Old Umtali, just before reaching the modern enlarged town, extensive groves of citrus trees are well established. Dropping to Umtali with its sub-tropical climate apple and pear growing is not easy, but oranges and other citrus fruits, mangoes, avocados, guavas, pineapples, granadillas, pawpaws, etc., flourish. With its rail head for distribution and canning and jam factories well established, Umtali is undoubtedly the key to this important district.

*The Rhodes Inyanga orchards are now being run by the Horticultural Section of the Department of Agriculture and Lands for experimental work in furthering Southern Rhodesian information on deciduous fruit growing.

The Vumba. Just out of Umtali is the Vumba area rising to 5,500 ft. along one side and dropping to 2,500 feet the other, the potentialities for fruit growing are excellent as is already instanced by existing plantings of all kinds of fruit, and the way guavas, tree tomatoes and granadillas have gone wild. Its easy reach to Umtali places the Vumba in a very favourable position.

Still heading south the present road to Melsetter passes through Cashel and Tandaai, also quite good fruit growing country.

At Melsetter fruit growing has been carried on since early days. It has probably the best prospects of the whole of the Colony, as temperate and sub-tropical fruit can be grown on the same farm where high and low ground exists. The soil is very fertile and water plentiful as the rainfall is high.

Poor Communications. The lack of a railway and a good commercial road has retarded progress in this area, which road difficulty is now being dealt with. Melsetter will then surely progress when its fruit will find wide outlets and ready markets.

Chipinga is a much warmer district and more suited to the growing of sub-tropical fruits. Distance and transport difficulties have been the main reason for not extending fruit tree planting. What then are the prospects of larger scale planting and marketing of fruit from these areas? First and foremost it must be clearly understood that just to plant fruit trees and expect to obtain good quality fruit by the previous methods adopted by most farmers will not further the fruit growing industry. If progress is to be made and larger scale planting entertained the success of such a scheme will only be brought about by specialisation.

High Quality. The future of fruit growing in this country will all depend on higher quality production which must be concentrated upon if markets are to be built up and retained.

While we have good markets and increasing demands for fresh fruits, much of it is imported, being well grown and excellently packed. We must be in a position to compete so that our own products attain this high standard and the public come to realise that Rhodesian fruit can compare favourably with what they have been accustomed to get outside. To begin with this means starting correctly with a careful selection of the site, which for tree fruits must have a good depth of fertile soil and no danger of water logging. Where sub-tropical fruit is to be grown pockets of low lying ground must be avoided on account of possible frost damage. Aspect is not of such major importance as the above factors, north, north-east and north-west being best. Shelter from prevailing winds may be necessary in exposed sites and need the planting of shelter belts. Whilst it is true that some fruit can be grown without irrigation, all fruits do much better and carry heavier and regular crops if means exist for watering in dry weather, this particularly applying to citrus trees. Thus a site with a good water supply is naturally an added advantage to better paying possibilities.

Deciduous trees need no water in winter until blossoms begin to unfold.

Varieties of Fruit. Suitable standard varieties known to suit the locality should be relied upon for large scale planting, which means ordering these trees well in advance to avoid substitutes. As these varieties vary to such a large extent in their behaviour it is hoped to devote a special article to them later on.

In the meantime here is a selection of fruits taken in order of ripening that generally suit areas 3,500 to 5,000 feet altitude:—

Apples. Christmas, Lady Carrington (Alma), Delicious, Versveld, Rome Beauty. Blenheim Orange Pippin, Jonathan, Rhode Island Greening, Oheninuri and White Winter Pearmain are extra kinds that suit 5,000 feet and higher.

Pears. Le Conte, Keiffer, Beurre Bosc, Packhams Triumph. At 5,000 feet and over, Clapps Favourite, William Bon Chretien, Beurre Hardy and Doyenne du Comice may also be included.

Peaches. Bell's November, Waldo, Bell's Improved, Killiekrankie, Early Mammouth, Kakamas Cling. All the above kinds plus Mamie Ross, Early Crawford, Million Dollar (J. H. Hale) for 5,000 feet and over.

Plums. Apricot, Methley, Santa Rosa, Satsuma, Wickson, Kelsey.

Nectarines. (Best kept to 5,000 feet range and over) Early Rivers, Goldmine.

Apricots. Early Cape, Alpha.

Quinces. Meeches Prolific, Cape Selected, Champion, Borrie.

Figs. White Genoa, Adam.

Almonds. Britz, Jordaan, I.X.L., Paper Shell. (Plant mixed varieties together for cross pollination.)

Cherries. (Only for over 5,000 ft.). Bing, Napoleon Bigarheau, Black Tartarian, Giant Heidelfinger. (Plant mixed varieties together for cross pollination.)

Pecan Nuts. All varieties, budded or grafted trees.

Other Fruits. Mulberries, Strawberries, Youngberries, Mexican Apple, Persimmons, Chestnuts, Walnuts, Olives.

The following sub-tropical fruits are for altitudes under 5,000 feet:—

Oranges. Washington Navel, Mediterranean Sweet, Valencia or Premier, Seville.

Grape Fruit. Triumph, Marsh's Seedless.

Lemon. Eureka, Villa Franca, Lisbon.

Naartjes. Old Cape, Emperor.

Avocados. Fuerte, Itzamna, Gottfried, Collinson (this variety requires another variety near for cross pollination).

Mangoes. Selected Seedlings.

Litchi. Layered trees.

Guavas. (White flesh) Parkers, Patnagola. (Pink flesh) Selected seedlings, Chinese, Srawberry or Cherry (small).

Grape Vines. (More satisfactory where the rainfall is less heavy toward ripening time). Catawba and Niagra varieties can be grown in most districts but lack flavour.

Red and White Hanepoort, Alphonso Lavelle, Barlinka and Barbarossa do well some years.

Other Fruits. Limes, Loquat, Bananas (Cavendish kind in frost free areas), Pawpaws, Tree Tomatoes, Walnuts and Chestnuts (Japanese), Pomegranates, Pineapples, Cape Gooseberries, Custard Apples (Cherimoyer), Granadillas.

For the deciduous fruit trees as apples, pears, plums, peaches, etc., it should be mentioned that the higher the altitude the greater the success should be with the crops of these trees. The sub-tropicals prefer the warmer areas, reasonably free from frost.

When to Plant. Being a summer rainfall area certain types of trees can be planted in the middle of the summer after the rains have well set in, this particularly applying to citrus trees from the open ground. Trees grown in tins can naturally be planted out at any suitable time.

Apples, pears, peaches, plums, apricots, quinces, grape vines, nectarines, figs, almonds, cherries, mulberries, chestnuts and pecan nuts are planted when dormant from mid-June to the end of August.

Planting Distances. All fruit trees should be planted at 20 or 24 ft. apart each way, except for the following:—

Pecan nuts 60 ft
Walnuts 40 ft.
Pawpaws and bananas 10 or 12 ft.
Litches and olives 30 ft.
Grape vine 10 ft.
Quinces 15 ft.

Granadillas are planted in rows at 10 or 12 ft. apart and the plants at 15 ft. from each other. Pineapples at 3 ft. each way. Cape gooseberries 3 ft. x 3 ft. or 5 ft. x 3 ft., depending on soil fertility. Strawberries 1 ft. x 9 ins. or 1½ ft. x 1 ft. Holes for tree planting should be dug 2 ft. square by 2 ft. deep. If the soil is virgin land or poor, a half paraffin tin of old manure or compost should be mixed in with it prior to planting.

Cropping. Peach and plum trees usually grow away fairly strong and may be encouraged to carry some fruit the second year after planting to steady them up. With citrus trees only a few fruits should be allowed to remain on the strongest trees until the third year of planting. Apple trees should not carry fruit until a year later, then only on the strongest trees.

Crop Disposal and Marketing. The marketing of fruit is often an art in itself. While one can be an expert grower the successful disposal of the fruit often calls for much talent.

Much of what one would and can grow will naturally depend on the possible outlet and building up of demands, this being a guide to extending the planting of particular kinds of fruit.

With the soft fruits and more perishable sub-tropicals large scale planting should not be indulged in unless one is fairly sure a good demand exists within reasonable distance. Where the intention is to supply fruit to factories for canning, jam and juice processing, discuss your supply position with the manager well in advance of fruit being available, or before planting.

Organised Selling. Other fruits that can be sent longer distances, marketing through an Association, Pool or Co-op., especially for the smaller grower, is the best method so that continuity of supply, orderly distribution, and exploration of markets may be specialised in. Otherwise where one has a fair extent of fruit trees, markets may be obtained by supplying to shops and stores, hotels and institutions, plus private orders.

Auction markets offer a ready means for disposal; except in time of glut, prices obtained are fair. For those entertaining this method of marketing, take the Market Master to whom you intend sending consignments into your confidence in advance, and let him know what quantity you estimate will be available. Ask him to advise the quantity you should consign each time and keep you informed.

Standardised Packs. Do not use all kinds and types of containers. Whatever is used try to keep to the same size and as near standard as possible. This makes for easier and better marketing with higher returns.

Emphasis must again be placed on quality. The conscientious grower who by detailed attention to culture, grading and packing turns out fruit of good quality, attractively packed, will find there are markets waiting whereby he can gain a good livelihood and reputation for an important industry.

How to Instal a Simple and Efficient Hot Water Supply on a Farm

By W. A. WELCH, Salisbury.

(Reprinted from R.A.J., November, 1938, by special request.)

To have a constant supply of hot water, whether in the bathroom, scullery and laundry, or outside, for dairy and other purposes, is an amenity on a farm that many would like to possess, and it is with a view to showing how it may be brought about that the following article is written. No attempt is made to meet the requirements of town dwellers, for whom qualified workmen are available for fitting up a hot water supply, although the principles involved in the following instructions, which can be carried out by the average "handyman," are exactly the same as for a town "villa" or a many storied hotel.

The writer has in mind that the petrol or oil drums so readily obtainable in South Africa will form the principal item of the installation. If one man has an old vertical steam boiler that is still watertight and another prefers to use a small boiler fitted at the back of the kitchen stove, the substituting of these for the steel drum boiler as herein described will make no difference other than that of larger or smaller heating surface; the pipe constructions will remain the same. There are two fundamental principles in hot water engineering that have to be borne in mind: (1) Water will always rise to its own level and (2) hot water is lighter than cold; the efficient working of a hot water installation is based on these two laws. The illustration Fig. 1 shows a tank A. and a vent pipe G. Now no matter how intricate the connections may be through piping and other drums, the water in pipe G. will always stand at the same level as in the tank A. The second principle works as follows:—Let us suppose an installation as shown in Fig. 1 is filled with cold water and a fire is lighted under B.; as the water in B. becomes heated it rises and passes through the pipe E. into the cylinder C., an equal amount of water replacing it by passing from C. down the pipe F. into the bottom of the boiler. This motion of the water (and it does actually move; it is not merely the heat radiating through the water) is called the "flow" and "return," and will continue as long as there is a fire to heat the water in the boiler. If the fire is allowed to go out, the hot water contained in B. and C. is still available for use, and when drawn off through the pipe H. cold water flows through pipe D. into the boiler, but not so as to affect the temperature of the water in C. until all the hot water is used up.

Water Supply. Now having tried to show the way the thing works, let us come to the actual installation, and for this we must start with the water supply. Some farmers are much better off in this respect than others, but for our purpose we may put them into three classes: (1) Those who have a supply brought to the house in a pipe line from a reservoir at some elevation above the house. These will need to fix a ball tap to the cistern A. (2) Those who have a reservoir or windmill tank at about the level of the roof of the homestead. These need not fit the cistern A., but may connect their supply of cold water direct to the bottom of the boiler. If the source is at some distance, the piping should be not less than 1 inch and fitted with a stop cock and, most important, it must be ascertained if there is any means of support for the vent pipe G., the top of which must be a foot or more above the highest level of water in the reservoir or tank. (3) Those who have to fill the cistern A. by hand or pump. These should endeavour to have as large a cistern as circumstances permit or the demand for hot water necessitates.

Cold Water Cistern. The distance of this from the boiler is immaterial and the most convenient spot may be selected for it. Its *height* requires consideration. The higher it is placed the faster will be the flow of water at the bath and other taps; on the other hand, it should not be placed so high as to create a difficulty in fixing the vent pipe G., the top of which must be a little higher than the surface of the water in the cistern when filled. It would not be advisable to poise a length of piping, say, 10 or 12 feet, on the top of C. without some lateral support (see under "Piping"). It is well to have a cover to the cistern to exclude mosquitoes, but it must not be airtight. The cistern requires one threaded socket at the bottom into which the pipe D. is screwed. This pipe may be connected directly to the bottom of the boiler or to pipe F. In either case it should be dropped slightly so that it enters the boiler or pipe F. from below. This will prevent any heat from creeping back to the cistern (see the T connection between D. and F. Fig. 1). Those who have a water supply at pressure (class 1) may fix their ball tap through a hole punched near the top of the cistern holding it in position by means of a back nut and fibre washer. They should also fix a short length of piping in the same manner to serve as an overflow.

Boiler. There are two types of drum commonly obtainable. One, either barrel shaped or straight sided, has two screwed plugs fixed in one end (Fig. 2), the other type is straight sided with the small plug at the end and the large one in the centre of the side (Fig. 3). Usually these plugs are ¾ inch and 1½ inch. To make use of these without alteration they must be fixed as shown in Figs. 2 and 3 respectively.

In Fig. 2 the flow pipe E. is screwed into the small socket and the return pipe F. and the cold supply pipe D. are connected to the large socket and an extension piece fitted inside the drum as shown by the dotted lines, reaching to within about 2 inches of the bottom. The manner of making the connection of this extension piece is given under "Piping and Connections."

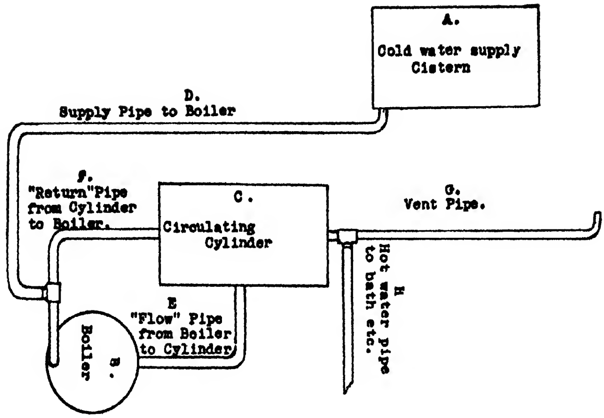


Fig. 1.

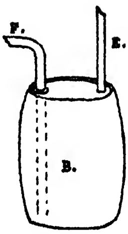


Fig. 2.

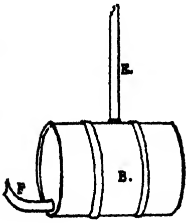


Fig. 3.

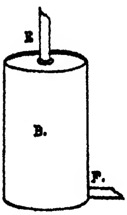


Fig. 4.

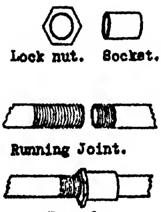


Fig. 5.

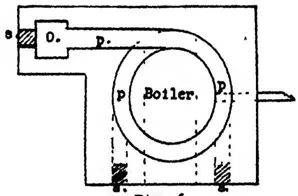


Fig. 6.

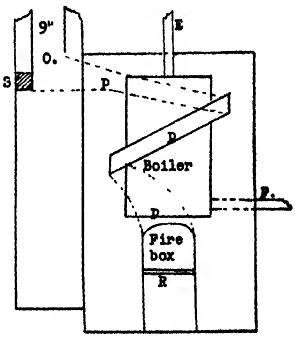


Fig. 7.

O. Chimney. P.Flue. R.Fire bars

The other type of drum must be built in horizontally, the "flow" and "return" pipes being connected as shown in Fig. 3. A third type for the boiler is shown in Fig. 4. This would probably require to have one connection specially brazed or welded into the position shown. A drum of the type in Fig. 3 can be adapted as follows:—First, permanently close the large plug at the side; stand the drum on end with a small plug at the top and have another socket welded into the position as shown in Fig. 4. The advantages of using the drum vertically as a boiler are referred to under the heading "Building."

Circulating Cylinder. For this a drum of the type in Fig. 3 is best, the two existing sockets serving for making the connections of pipes E. and G. (Fig. 1). Another socket must be welded in for the connection of pipe F. In erecting this cylinder the height is determined by the boiler B. and the cistern A. It must be sufficiently higher than the boiler to allow of pipe E. being easily connected, but as much below A. as is practicable. In any case the T connection between G. and H. must be lower than the bottom of cistern A., the lower the better. The nearer the cylinder is kept to the boiler the better. If the latter is being totally enclosed in brickwork the cylinder may be enclosed in the same structure, or if the kitchen or scullery be handy it may be fixed indoors. It is advisable not to have it exposed to cold wind or frost.

Piping and Connections. As a general rule $\frac{3}{4}$ inch piping will suffice, this being the size that fits the small sockets in the drums. The large sockets have to be fitted with "bushes," obtainable from piping suppliers, so as to reduce them to the $\frac{3}{4}$ inch. The piping G. from the T upwards need only be $\frac{1}{2}$ inch. If a little extra expense in having larger sockets fitted to the drum is no obstacle then pipes D., E. and F. can with advantage be 1 inch. The outlet at the top of C., the T socket and the hot water draw off pipe H. need not be larger than $\frac{3}{4}$ inch. Presuming that the bathroom and other taps are on the ground floor then the T socket should be close to the top of C. If the installation is in a storied building and the hot water is required on an upper floor then the cistern A. and the vent pipe G. must be carried correspondingly higher and the T connection taken off at a convenient point.

In running the pipe line H. to the bath or other points for drawing off keep it on a descending line as far as possible and only rise again to a point where there is a tap. Use a spirit level for this if necessary. The reason for this is that air may enter this pipe and it should be higher at both ends than the central portion so that air may escape either to the vent pipe G. or by one of the taps. Do not have a high spot where air may be trapped.

The length of pipe G. is to be carried slightly higher—say, 12 to 24 inches—than the level of the water in A. when full, and it is advisable to fit a bend at the top pointing in a direction that will avoid any person being scalded, as, should the fire under the boiler be too fierce, steam and boiling water will gush out of this vent pipe. It should, if possible, be kept vertical,

but if necessary to run it obliquely at a gable end in order to reach a chimney for support, keep it rising as sharply as possible. As it is not possible to make every joint between A. and B. and B. and C. with the ordinary screwed and socketed joint, one of the joints has to be fitted specially. There are fittings made for this purpose called "union sockets," but the expense of these can be avoided by making a joint, as shown in Fig. 5, at some convenient point between the two drums to be connected. In addition to the ordinary socket a back nut is required. To make this connection work back from both drums so as to have two lengths of piping meeting true and close. On one length the thread is cut the usual length, on the other it is cut long enough to take the back nut and the full length of the socket. Screw the back nut on first, then the socket until it is back flush with the end of the pipe. Bring the ends of the two pipes together and screw the socket forward until it is tight home on the short thread. The back nut must now be screwed tight up to the socket, some packing tow smeared with the jointing compound being first wound round the pipe between the back nut and socket. One of these called "running joints" is necessary in pipes D., E. and F., and it is advisable to make use of one or more of these indoors. It simplifies fixing and taking down for alteration, etc. Where possible use "bends" in preference to "elbows" when making rectangular joints, particularly in pipes E. and F. To fit the length of piping inside the drum—Fig. 2—measure the depth of the drum inside and cut off a length of piping about 1 inch shorter. Cut thread at one end long enough to screw through the reducing bush and to project half the length of a socket. Screw the piping into the bush, fix the socket on the projecting end then screw the whole into the drum.

Tools, Etc. The following tools are necessary, excepting in cases where the piping is being cut and screwed to measurement by pipe merchants:—Hack saw, coarse file, pipe stock and die, two pipe wrenches, vice. If a pipe vice is not available a leg vice or bench vice will do; an assistant with a pipe wrench to grip the pipe that is being screwed can supplement the grip of the vice.

To those inexperienced in cutting thread on piping the following advice is offered. If the end of the pipe has not been cut off square, have it square and slightly round off the outer edge with a file. Do not attempt to cut the thread the full depth at one cut. Pipe dies are adjustable and a light cut should be made first, and by going over the length of thread that is being cut four or five times, adjusting the dies to cut a little deeper each time a cleaner thread is cut and it is better for the dies. Keep a little oil on the thread whilst cutting. It is well to use a jointing compound to ensure a water tight joint, failing anything better ordinary oil paint will do; red lead is better or there is a steam jointing compound sold that is good, as it allows of joints being unscrewed more easily when alterations, etc., may be necessary.

Building in the Boiler. The type of drum for the boiler that will appeal to most as being simple to fix is the horizontal type (Fig. 3). Where economy of fuel and the absence of smoke and

ashes are of little account it may be just built on a brick pedestal with a fire box underneath and a dwarf chimney at the back. This may be improved upon by raising the chimney and also by arching the top over with brickwork either with or without a cavity extending from the fire over the top of the boiler and back to the chimney. In whatever way it is set do not have any of the pipes or connections exposed to the fire or you will soon have leaking joints. A much better job is to fix the boiler vertically as shown on sketch and plan Figs. 6 and 7. This requires a chimney, preferably at the side and built independently so that in the event of the boiler requiring to be re-set at any time the fabric of the chimney is untouched. Fig. 6 shows the boiler over the fire box, which is provided with fire-bars for about two-thirds in from the front and extends inwards about 9 inches beyond the boiler; a flue 4 inches wide by 6½ inches (two bricks) high is carried from the back of the fire once round the boiler and rising gradually so that it enters the chimney at about the level of the top of the boiler. This will be found to have a greater heating efficiency with a lesser amount of fuel than a straight through fire under a horizontal boiler. The chimney should be 9 inches square inside and, in building, holes should be left at the three places marked S. to allow of the. flue and bottom of the chimney being cleared of soot or ashes. These "soot doors" should be the size of half a brick, and when the building is completed they should be closed by inserting a half brick just "pointed" with mortar—a piece of hoop iron hooked at both ends being inserted under the brick to facilitate withdrawal.

Breeding of Poultry for Economic Qualities

By A. A. REED, Assistant Poultry Officer.

All poultry farmers are interested in means of keeping down costs of production and so obtaining greater profits, especially as poultry feeds are so high in price. One of the most important ways of reducing costs and making more efficient use of food is to breed birds which give a high average production and which have a long productive life. Improvements in feeding and management have made it possible for hens to lay 300 eggs or more, provided they have the inherited ability, but progress in breeding has not kept pace, and flock averages of 200 eggs per bird are not common. Yet such averages are possible, and even higher averages have been achieved with our present knowledge of breeding.

Breeding for improved production is not only of importance to farmers breeding their own replacements and to breeders selling day-old chicks and breeding stock. It also directly concerns those poultry farmers who buy all their replacements, as the production of these will depend on ability of the breeder from whom they come. The economic qualities required by poultry farmers are a uniformly high production of large eggs with good shell texture and internal quality. Hatchability of the eggs should be good and the chicks should grow out quickly and show low mortality. The pullets should also have low mortality, be resistant to disease, and maintain a good production in their second season. The birds should be uniform and conform reasonably to their breed standard.

More poultry farmers are becoming sellers of day-old chicks, and as competition becomes keener, only those who breed birds which show consistently good results at egg laying tests, and in their customers' flocks, will have a brisk demand for their stock at remunerative prices. Many farmers, however, have the idea that breeding is much more of an art than a science and that only certain people have the gift for it. But as more is being discovered about the scientific side of breeding, it is developing into a science rather than an art. Thus the poultry farmer who is keenly interested in his birds, observant, and prepared to keep accurate records, is well equipped to become a successful breeder, provided that he keeps in touch with the latest advances in breeding practice.

Early experiments in the breeding of poultry for egg production were disappointing. Professor Gowell mated up for eight years in succession cockerels from dams which had laid over 200 eggs to hens which laid 150 eggs or more. Yet the average pro-

duction of the pullets was 136, 143, 156, 135, 118, 134, 140 and 113 eggs in successive years. Pearl and Surface hatched pullets from hens laying more than 200 eggs mated to cockerels whose female ancestors had laid more than 200 eggs for seven generations, but obtained no better results. Thus, breeding based only on the production records of the parents was not successful in raising production at all. Rice and Botsford state that "Selecting and mating birds on the basis of high production alone will eventually result in impaired vitality, lower egg production, smaller birds and eggs, and ultimate failure." Yet many breeders continue to select and buy birds on their parents' production records only.

Much more progress is being made by those breeders who have made a study of how egg production and other economic qualities are inherited, and who use the progeny test as well in identifying their best breeders. Before considering actual methods of breeding, it is advisable to examine how these can be used to improve results.

1. INHERITANCE OF ECONOMIC QUALITIES.

(a) **Inheritance of Egg Production.** The inheritance of egg production has always been difficult to measure, because it shows itself only in the hen, and her actual record is affected by her date of hatch, and by environmental conditions such as climate, feeding, management, housing, and disease. Fortunately Goodale and Hays discovered that total egg production is due to the interaction of five different, separately inherited characters, and that total egg production is not inherited as one whole. This has made it easier for the breeder as he can identify the characters more definitely, and by selecting for them individually and fixing them in his strain, he can make more progress than by selection on total record. The five characters concerned are sexual maturity, intensity of production or rate of laying, winter pause or winter moult, broodiness, and persistency of production into the autumn.

Maturity is measured by the age of the pullet in days when she lays her first egg. There is a close relationship between earliness of maturity and the intensity and persistency of production which the bird will show. Early maturing pullets also have a longer laying season than the late maturing birds, as they have a longer time to lay before the moulting season. Dual purpose pullets that start laying before 215 days of age and Leghorn pullets that start laying before 200 days of age are early maturing. Birds that mature very much earlier, however, may be undersized and lay very small eggs. It is therefore necessary to emphasise good body size and good egg size at first egg while selecting for early maturity. Leghorn pullets should weigh 3½ lbs. or more, and dual purpose breeds 5 lbs. or more at first egg. Early maturity is a character that is easy to fix in a strain by using breeding hens that were early maturing and males whose sisters or progeny were all early maturing.

Intensity of production or rate of laying is a very important point in determining how many eggs a bird will lay. Hens lay their eggs in clutches, a clutch consisting of the eggs laid on

consecutive days without a break. The hen laying clutches of single eggs can only lay fifteen eggs in a thirty-day month, a hen laying two eggs per clutch will lay 20 eggs, and a hen laying three eggs per clutch will lay 23 eggs. Birds which lay three eggs or more per clutch in the winter months are considered to have high intensity. Rate of laying can be measured by working out the average clutch size for the months of March, April and May, taking the total number of eggs laid and dividing by the number of clutches. Another method is to make the standard a minimum of 23 eggs per month for two of the three months—March, April, and May. An advantage of measuring intensity of production at this time is that cockerels can be selected for mating up in June on the basis of their sisters' intensity.

A winter pause is taken to be any break in production of more than seven days during the winter months. It is a character which is due partly to inheritance and partly to environment, such as sudden climatic changes, change of feed, or rough handling. The date of hatch is also important, as early hatched pullets are more inclined to moult. The pause may be only a week to ten days, or the bird may neck-moult and be out of the lay some weeks, while in extreme cases the bird may moult completely. Under good conditions of management, however, many pullets will continue laying without a break, and these birds should be selected for breeding. This character is of great economic importance, as eggs are lost during the period of highest prices. Non-pause is the most difficult character to fix in a strain, but by the continued selection of hens free from pause, and the use of sires whose sisters and progeny show little or no pause, both the length of the pause and the percentage of birds showing pause will be reduced.

Broodiness is a character which affects the dual purpose and heavy breeds, but is very seldom found in Leghorns. On an average, even if the broody hen is placed in a broody coop immediately, each period of broodiness causes a loss of fifteen days of production. Non-broody families have shorter winter pause and a lower percentage of winter pause, than broody families. Broodiness is a difficult character to eliminate completely from a strain, but by using hens only from non-broody families, and sires whose sisters and progeny are non-broody, both the percentage of broodiness and number of times the birds go broody will be very much reduced. An interesting point is that crossing of strains in a breed, or the crossing of breeds, even when the Leghorn is the one parent, often results in more broodiness than in the parents.

Persistency of production or laying late into the autumn is the most important character affecting total egg production. Early moulters do not have a long laying season, and lay less eggs. Select for breeding only those hens which have laid for 300 days at least, preferably for 365 days or more. The date of the last egg is also a good measure, especially if the birds were hatched over several months, as late hatched pullets do not have the same chance of laying for a long period. Birds selected for breeding should still be in the lay on the 1st March.

The relative importance of these five inherited characters is shown below in the table from Hays, which gives the average production of birds possessing all five desirable characters as compared with the production of those possessing four but lacking one:—

Class.	Av. Production.	Difference.
Possessing all five...	251.6 eggs	—
Lacking early maturity ...	344.7 eggs	6.9 eggs
Lacking intensity...	220.2 eggs	31.4 eggs
Lacking non-pause	227.4 eggs	24.2 eggs
Lacking non-broodiness ..	234.8 eggs	16.8 eggs
Lacking persistency	196.4 eggs	55.2 eggs

By basing their selection on these characters instead of on total egg production, and by fixing each character in turn in their flock with the aid of the progeny test, Goodale, Hays and Sanborn raised the average production of unculled Rhode Island Red pullets from 114 to 235 eggs. Taylor and Lerner improved the average production of an unculled White Leghorn flock from 217 to 243 eggs per bird on the same system.

(b) **Inheritance of Egg Qualities.** Egg size is of great economic importance as on all markets the 2 oz. egg is standard. Smaller eggs are sold at lower prices, and usually there is a poorer demand for them. On the other hand extremely large eggs are difficult to pack, are likely to have poorer shells, to give lower hatchability, and to cause prolapsus. Egg size is related to body size within a breed or within a strain. Undersized birds rarely produce large eggs. It is advisable to select only those hens for breeding which reached 2 oz. weight within two months from starting to lay. Dr. Bronkhorst showed that the average egg weight of all eggs laid in August of the pullet year corresponds very closely to the average annual egg weight. Thus eggs need be weighed only during this month, and will give an accurate comparison between birds. Pullets should average 2¼ oz. or better to qualify as breeders the next year.

Egg shape is important in packing eggs. Extremely long or extremely round eggs are likely to crack and leak in egg boxes, so it is always advisable to select hens laying normal shaped eggs for breeding.

Egg shell texture is very important in determining the treatment eggs will stand without breaking, and the number of cracked eggs which will occur in the nests. In America a strain has been bred where 8 lb. pressure is required to break the shell, as against the normal 4 lbs. Thick shelled eggs usually hatch better than thin shelled eggs. As high temperatures normally depress shell thickness, and as eggs often have to be conveyed over long distances, selection for egg shell thickness is of especial importance in Rhodesia.

Shell colour is not so important. Nevertheless it is possible by breeding to eliminate tinted eggs from the light breeds, and to breed for a darker shell in brown egg breeds. It has recently been shown that medium and dark shelled eggs usually hatch better than light tinted eggs in the case of brown egg breeds.

(c) **Hatchability.** Hatchability, or the percentage of fertile eggs which hatch, is influenced both by inherited and environmental factors. As all hens in the same flock will have the same environmental conditions, however, any difference between hens will be inherited.

The feeding of a balanced ration containing sufficient minerals and vitamins, keeping the eggs not more than seven days at a temperature between 45° F. and 60° F., and incubating at the correct temperature and humidity, are the most important factors in getting best results.

Under these conditions, only hens who gave 85% hatchability or more should be used again as breeders, and only males from such hens should be selected for mating.

High egg production itself does not cause low hatchability. Eggs from medium to high producers usually hatch better than those from low record hens, and hens laying at a fast rate during the incubating season will as a rule give better hatching results than hens laying at a slow rate. Pullets give better results than as hens, and hatchability decreases with age.

Inbreeding often causes decreased hatchability, while out-breeding or crossing usually improves hatchability.

Hatchability is of great economic importance to the day-old chick seller and can be fixed fairly easily in a strain.

(d) **Inheritance of Constitutional Vigour or Viability.** Jull has stated that the loss from adult mortality is the most important single factor affecting financial returns in the United States of America. Laying pullet mortality has increased out of all proportion to any increase in production per bird. This is also borne out by the gradual but consistent increase in mortality at laying tests all over the world, and they are made up of selected birds!

Too many breeders have become obsessed with breeding for high records only, and have taken no account of the mortality occurring among their birds, as long as the survivors had good records. The practice of mating up mostly pullets for the sale of day-old chicks has also increased flock mortality, as many of these pullets may die before the end of their first laying year, and this constitutional weakness is passed on to their chicks.

Unfortunately constitutional vigour cannot be judged in the individual bird. High vitality can be recognised by the activity, alert carriage, and appetite of the bird, and by its bright prominent eye, good size and muscling, good condition, and tight feathering. While this helps in eliminating low vitality and unhealthy birds, high vitality is not a measure of whether the bird will give good hatchability and produce quick-growing healthy progeny, which will lay well for a number of years, and

have low mortality at all stages. The best measure of constitution in the individual bird is its ability to live for a number of years, also called longevity, and to produce well throughout its life.

The true test of constitutional vigour is the bird's progeny. Less than 10% of a family should die between hatching time and six months of age, and less than 15% of the pullets in their first laying year, including those culled. Hays found that pullets increasing their weight by 1½ lbs. between hous ng time and 1st September, had the lowest subsequent mortality.

Disease resistance is also inherited, but resistance to each disease is inherited separately. No treatment is known for range paralysis and other forms of cancer, and these diseases cause a large percentage of mortality to-day. Breeding for resistance to them is the only control measure known, and families in which range paralysis or cancers occur should be eliminated. Fortunately range paralysis usually shows itself between three and fifteen months of age, so that by breeding from hens, only resistant birds will be used. Avoid all birds which have had disease of any kind, as they may reproduce lack of resistance in the strain.

High egg production and good constitutional vigour can successfully be combined in the same strain, and breeding for constitution must be an essential point in every breeder's programme.

(e) **Inheritance of Table Qualities.** Table qualities are important to the table poultry producer and to the breeder of dual purpose breeds. Even the fleshing of the Leghorn can be improved by selection, and as the present day demand is for a smaller table bird to suit small families, this may become important in the future.

Rate of growth is important, as this determines how soon a bird will be ready for market, and is also a measure of how efficiently it uses its food. Differences in growth rates are inherited, and by weighing chicks at six weeks of age, a very good idea can be obtained, and the strain improved in this respect.

Fleshing on the breast and thighs is important, as a razor-shaped breast and scraggy thighs present a poor appearance in a dressed bird, besides indicating a lower percentage of meat in the carcase. For practical purposes three grades of fleshing can be made for recording purposes:—

A. Birds with well-rounded, plump breasts.

B. Birds with medium breasts.

C. Birds with deep, angular breasts.

Males with "A" shaped breasts will be used for breeding provided they have all the other essential qualities.

Crooked breastbones spoil the appearance of dressed table poultry. When 50% or more of the birds show crooked breasts, this is probably due to lack of sunlight, causing rickets, insufficient calcium and phosphorus in the ration, or giving the chicks narrow perches before their breastbones have hardened.

In this case management is at fault. When only five to fifteen per cent. of the birds show crooked breasts, this is likely to be an inherited weakness and such birds should not be used for breeding.

Most chicks of the dual purpose breeds are slow to feather, in contrast to Leghorn chicks, which are quick feathering. This means they are more susceptible to cold snaps and chilling. In addition cockerels especially may still have pin feathers on the backs at killing time (bare back broilers) which are difficult to pluck and give the dressed bird a poor appearance. Slow feathering birds are more inclined to develop breast blisters. In most dual purpose breeds a few chicks with fast feathering appear. Mr. G. H. Cooper found them in Australorps and gives a good description of how to identify them and fix fast feathering in the strain in Bulletin No. 1186, obtainable from the Department of Agriculture, Salisbury. They also occur in some strains of Rhode Island Reds, Wyandottes, and Light Sussex, and can be used to fix fast feathering in these breeds.

(f) **Inheritance of Show Points.** If the flock is only kept for commercial egg production, major defects such as deformities, badly crooked breast bone, heavily feathered shanks, light and odd eyes, and irregular pupils, which are heritable, should not be allowed in any breeding pen. It has recently been shown that White Leghorn pullets with good eye-colour and round, regular pupils, give better production and lower mortality than pullets with light eyes and those with irregular pupils.

The breeder who sells day-old chicks and breeding stock, must consider the breed standard, especially if he enters at egg laying tests, where birds must be free of all disqualifications and should conform reasonably to the standard of the breed. Each breeder often has his own particular interpretation of the breed standard, and many strains can be identified by their particular size and type.

Too much emphasis on the breed standard will result in many good breeding birds being discarded for minor Show points, and slow up the progress in breeding for productive qualities. Mr. Boutflour has said in regard to dairy cattle, that either there is a relationship between Show points and utility, or there is not. If there is, it is unnecessary to select for Show points, as they will come automatically if selection is purely on economic qualities. If there is no relationship, selection for Show points is leading breeders astray in breeding for production. These remarks also apply to poultry.

2. THE PROGENY TEST.

The object in breeding from a bird is to obtain a large number of uniformly good progeny. Although a bird's records and pedigree may help in selecting it for breeding, the acid test of its value as a breeder is its ability to produce progeny with as many desirable qualities as possible. As a male has no production record himself, the progeny test is the only means by which his inheritance for production can be measured.

As two parents are required to produce progeny, and as each contributes half to their inheritance, the progeny test is really a test of the mating. Nevertheless the average of all the progeny of a sire mated to five or more hens will give a very accurate idea of the qualities he will transmit when mated with other hens of the same strain. Even if a sire has proved superior, however, it may be found that certain hens have not given good progeny by him, and they should be discarded. If a sire has proved inferior, the hens which give the best results with him can be tested with another male the next season. Successful matings should be repeated as long as possible.

Once the record of the progeny are known, the birds' own records cease to have any importance. For instance, an R.O.P. White Leghorn cockerel whose dam laid 216 A 4 B eggs was mated to an R.O.P. hen which laid 213 A and 2 B eggs, but had no pedigree. The average of their seven daughters was 247 A 3 B eggs, and one daughter laid 316 eggs. The records of the parents now cease to matter, as the average production of the progeny give a much more accurate idea of how they breed.

The most important requirement in progeny testing is that there must be a sufficient number of progeny, which must not be culled. Judgment should be based on the uniformity and average quality of the offspring.

Mueller and Hutt state that five to six daughters give about as much information on the level of production transmitted by the dam as is obtained from a larger number.

But to obtain a progeny test of constitutional vigour or viability at least thirty daughters are needed. Hens rarely give more than 20 pullets in a season, so their viability cannot be measured. It is advisable, however, that a full progeny test of a sire should therefore be based on at least 30 unculled pullets.

The biggest obstacle in progeny testing most animals is the time required before the test is complete. Fortunately poultry give a large number of progeny, quickly. A bird used one breeding season has already given sufficient progeny, and the progeny test is already half complete before the next breeding season arrives. Hatchability, rearability, freedom from defects, maturity, intensity, egg size, and to a large extent winter pause of the progeny can all be measured before the bird is used as a breeder again.

Lush states that "the chief practical limitation of the progeny test is that it comes so late in the animal's life that most of the decisions about culling or using an animal for breeding must already have been made. Therefore progeny tests have their widest use in making pedigree selections more accurate by pointing to sires and dams whose offspring are most likely to be worth saving for breeding." Progeny tests show which families are superior, and enable the breeder to select superior animals belonging to superior families for further progeny testing.

Males and females from families where the sisters only have made known records are called "sister tested." Where the brothers also have been tested for qualities that are shown by

the males, e.g., growth, feathering, viability, they are called "sib tested." The term "sib" here refers to a family of full brothers and sisters.

Godfrey found that the average production of all of a cockerel's full and half sisters with a minimum of twenty gave an accurate indication of his own daughters' probable performance. This was more accurate than the average of his full sisters only. Naturally, however, a breeder will select cockerels for progeny testing whose full sisters gave the highest average production and were fairly uniform. Full brothers will still vary in the production and other economic qualities they transmit, but they are all likely to give good results if their sisters are uniformly good. The males from the R.O.P. mating mentioned earlier, whose sisters averaged 247 A 3 B eggs, would be much safer to use than cockerels from a 300-egg hen whose breeding performance is unknown.

The buying of "sister-tested" or "sib-tested" cockerels is one way in which a breeder who does not wish to do much recording can improve his stock. By purchasing such birds regularly from a reliable breeder, he can make use of the other farmer's progeny testing, but he must be prepared to pay higher prices than for just ordinarily pedigreed males.

The progeny test combined with the sib test offers the surest and quickest means of making progress toward any desired goal in the hands of the good breeder.

3. BREEDING SYSTEMS.

The relative merit of the different systems of breeding are still the cause of much argument among breeders. The principal systems are inbreeding, linebreeding, outbreeding, cross-breeding and grading.

(a) **Inbreeding.** Most animals within a breed are related even though very distantly. Thus inbreeding really means the mating together of individuals that are known to be related by their pedigrees. Closest inbreeding is the mating of full brother and sister. Mating of father to daughter and mother to son are also close forms of inbreeding. The mating of first cousins or more distantly related animals is usually considered as mild inbreeding.

The main effect of inbreeding is to increase the probability that the progeny will inherit the same thing from their sire and their dam, as they are both related. It thus makes inbred individuals breed truer for the characteristics they possess, both good and bad. Only when a breeder feels that he cannot improve his birds any further, should he inbreed closely, as their bad characteristics will be fixed in the strain just as much as the good ones. Inbreeding can only fix those characteristics that are present in the animals that are inbred, and if a desirable characteristic is missing, it will always remain absent in the progeny. For instance, if a related group of fowls all with small eggs are inbred, egg size will always remain small in their progeny.

As inbreeding is very quick to show up weaknesses in an animal, Wriedt has suggested that a sire should be mated back to his own daughters for the progeny test. In poultry close

inbreeding has usually resulted in reduced hatchability, somewhat lower production, and considerably higher mortality in the pullet year.

In the United States of America attempts are being made to establish inbred lines of poultry, for crossing with each other to give hybrid fowls for sale commercially as is done at present with maize. The costs of breeding such lines, and the losses from those which have to be discarded, are however much higher than with the plant breeder, and its economic value is not yet proven.

(b) **Linebreeding.** Linebreeding is a special form of inbreeding in which the breeder keeps all the animals closely related to a certain valued individual or line. Usually an animal is said to be linebred to a certain animal or to a certain family. Linebreeding attempts to concentrate the favourable qualities of an individual into the flock, by increasing the number of times it comes into the pedigree.

The special danger in linebreeding is that the animal to which the linebreeding is done, may have been considered desirable purely on its own records. If it is selected on the basis of its superior progeny, however, linebreeding will help in fixing those characteristics in the strain. It is interesting to note in flocks where progeny testing is practised, how frequently the valuable progeny tested sires occur in the pedigrees of present birds.

(c) **Outbreeding.** This has the opposite effect to inbreeding. While the progeny of the outbred mating are very uniform, they themselves breed birds lacking in uniformity.

It is most valuable, however, in introducing desirable characters which are lacking into a strain. Where the birds in a strain all lay small eggs, the quickest way of improving them is to introduce birds from a strain which lays large eggs, trying at the same time to have them as alike as possible in other respects to the breeder's own strain. When introducing a new strain, the progeny of the mating should first be thoroughly tested before widespread matings between the two strains are made.

If an inbred line shows considerable degeneration in hatchability, egg production and mortality, it will also be advisable to test an outbred mating for improving these points.

(d) **Cross-breeding.** The crossing of birds usually results in the first generation of the progeny being superior to the average of the parents, especially in growth, efficiency in using food, and mortality, due to hybrid vigour.

The crossbred birds, however, are not satisfactory as breeders, and the cross must be repeated each time. Therefore pure-bred birds of the one breed must be kept, and males of the other breed purchased, or both breeds must be kept as well as the crossbreds.

Cross-breeding is of greatest value to the table poultry producer, and to the buyer of day-old chicks who does no breeding himself.

A special form of cross-breeding is the production of sex-linked crosses where the cockerel and pullet chicks can be identified at day old. The breeder is then able to sell pullet chicks to customers wanting them only, and cockerel chicks to customers rearing table poultry. There are three types of crosses which can be made.

In the gold and silver cross, cockerels of the Rhode Island Red, Buff Rock, Brown Leghorn, Indian Game, or Black-red or Brown-red Old English Game can be mated to Light Sussex or White Wyandotte hens. The pullet chicks will be buff to red, and the males white or light cream in down colour.

In the barred and non-barred cross, cockerels of any black breed, and Rhode Islands, Buff Rocks, Brown Leghorns, Indian Game, and Black-red or Brown-red Old English Game, can be mated to Barred Plymouth Rock hens. The pullet chicks will be all black on top of their body, with dark beak, shanks, and toes. The cockerel chicks are black above, but have a white spot on the head, with lighter beak, shanks, and toes.

The third cross makes use of the rate of feather growth. It is the only one of the three crosses which makes use of the White Leghorn. The hens used, however, must be pure for slow feathering, and it is advisable to read Bulletin No. 1186, by Mr. G. H. Cooper, to find out how to identify these. White Leghorn cockerels mated to Australorps, Rhode Island Reds, Plymouth Rocks, Light Sussex or Wyandottes, will give male chicks in which the primary feathers in the wing are just visible, to ¼ inch in length, at day old. The pullet chicks will have primaries at least ½ inch long at hatching time.

None of these crosses will be successful for sexing chicks if made the reverse way, however.

(e) **Grading.** Grading is seldom practised with poultry, as sufficient pure-bred day-old chicks or breeding stock are available. By buying well-bred chicks or breeding stock from a good breeder, a poultry farmer can start at the level which that breeder has reached, instead of grading up a flock of mongrel fowls of low production.

The breeder should not slavishly adhere to any particular system of breeding but should vary his system to make use of the information he gets from his own observation, records and progeny tests. To obtain a flock which will be uniform and breed fairly true for the characters he desires, he will probably practise a certain amount of inbreeding. The results of his progeny tests will, however, be the main guide in his decisions.

4. METHODS OF MATING.

(a) **Flock Mating.** A flock mating consists of a number of males mated up to a large number of hens. In light breeds one male is used to every twelve to fifteen hens, and in dual purpose breeds one to every eight to twelve hens. The maximum number of males are used in the beginning of the season, and as certain birds are bullied or lose condition, they are removed. It is not advisable to add males later, as these are attacked by all the males in the pen. Fertility is usually highest from flock matings.

(b) **Pen Mating.** Each pen of hens is mated to one male. Fertility may not be so good, as the male may not mate with a certain hen or hens. In pedigree hatching, however, these hens can be identified and placed in another pen.

This method involves a large number of small houses, but is the method required when breeding for flock improvement.

(c) **Stud Mating.** The matings between the female and male are controlled. If the hens are in single pens, the male may be put with five to six different hens each day, and as fertility remains good for a week, a valuable bird may be mated to 30 or more hens, resting him on Sundays.

When the hens are trapnested, the male may be kept in a large coop in the pen, and the hens are put with him one at a time, and removed as soon as they have been mated. A card with all the hens' band numbers is placed in the house, and after trapping a hen it is consulted to see when she was last mated. If that hen has not been mated for a week she is put with the male. The cock should be given a big pen in which to exercise and rest on Sundays.

Stud mating is especially valuable for obtaining large numbers of chicks from good progeny tested cocks.

(d) **Artificial Insemination.** While artificial insemination has not yet become important in poultry breeding, it offers an excellent way of making the most use of valuable progeny tested cocks, especially as they are not so active when three or four years old.

A male will give approximately 1 c.c. of semen per day, and 0.1 c.c. is sufficient for inseminating each hen. Fertility remains good for seven to ten days, so that up to 100 hens can be bred to a valuable male.

It can also be used to fertilise hens in laying cages.

5. A METHOD OF BREEDING WITHOUT TRAPNESTS.

At present a large number of poultry farmers mate up their birds purely on outward appearance, without any knowledge of their production, pedigree, or relationship. In most cases flock matings are made, and the progeny of each bird cannot be identified. On this system no improvement occurs and the stock is merely multiplied.

A more advanced system is pen mating when the breeder purchases a pedigree male with good records, and mates him to the best of his hens to provide cockerels for flock mating the next year. The chicks from this mating are marked by toe-punching or wing banding, so that the sire is known. The pullets from this mating unfortunately are usually kept with flock pullets, so that their production is not known, and the cockerels are used irrespective of whether their sire has improved production or not. The usual pedigree of a sire is not a reliable indication of how well he will breed, as all that is given is the pedigree of the bird and the egg records of his female ancestors.

If, however, the records of his full and half sisters can be obtained from the breeder, and they are satisfactory, progress can be made, but unfortunately there are not many breeders who can give this information.

The commercial egg producer, however, rightly claims that the increase in production will not justify the extra time and labour required in trapnesting and pedigree breeding. But a simplified system of breeding which makes use of all the latest advances in breeding knowledge, with the minimum amount of extra work and record keeping is suggested below. It involves the farmer in very little more recording than is practised on the up-to-date commercial poultry farm to-day. One small notebook is sufficient to keep all the details of matings, toe-punches, and other records for the year.

(a) **Selection of Breeders.** Coloured celluloid legbands are used for marking which pullets show the desired inherited characters which go to make up good egg production. To do this all pullets must be handled three times during their laying year.

Each hatch should be given a special identification and as far as possible kept separate. At 200 days of age in light breeds and 215 days in dual purpose breeds, all pullets of that hatch are handled and those which have started to lay as shown by large moist vent and red comb are given a red celluloid ring to show they are early maturing. Early maturity is the least important of the five characters involved in production, and is important mainly as an indication of good intensity and persistency of production. If it is difficult with a large number of hatches to keep pullets of different ages separate, the character need not be identified, but all obviously late maturing pullets should be discarded.

On the 1st July all pullets are handled carefully and judged for intensity of production to date. This will be shown by bleaching of all yellow pigment from the beak, bottoms of feet, and possibly front of shank in yellow-shanked breeds such as Leghorns and Rhode Island Reds. In Australorps and Sussex lack of surplus fat, large capacity of the abdomen, hard dry feathers and frayed tail feathers are the only indications. A white celluloid band—white for bleaching of pigment—is given to all birds showing signs of good winter production.

Pullets pausing or moulting during the winter, as shown by new feathers and a shrunken comb, should be caught as they are seen with a catching hook and banded with a yellow celluloid ring—yellow for yellow pigment returning to beak.

Each time a bird goes broody it is given a black ring, so that the number of black rings on a bird indicates the degree of broodiness.

Finally on the 1st March the following year all birds are examined and those still in production are given a blue ring. In yellow-shanked breeds, the hens which have lost most yellow pigment will be the best layers.

At this handling the birds should also be thoroughly examined for vitality, freedom from serious defects, a clean broad, deep head with short well-curved beak, and good weight. Leghorn

hens for breeding should weigh four to five lbs. and Australorps and Rhodes six to seven lbs. and Light Sussex slightly heavier. Hens with these points and red, white and blue rings, and no yellow or black rings, will be selected as breeding birds, and forced to moult so as to be in good condition for the hatching season.

(b) **Dr. Hagedoorn's System of Male Progeny Testing.** This is a simplified method of progeny testing suggested by Dr. Hagedoorn in which the male only is progeny tested. It avoids the necessity of trapnesting, and has proved very successful in practice. A strain of Khaki Campbell ducks in Holland was bred up from an average of 225 eggs per duck to just over 300, using this method.

The system is as follows:—

First Year. The breeding hens are selected on the above system. These hens are divided up into a number of pen matings which should be as alike as possible, so that each male has the same chance of proving his breeding ability.

Either there must be enough breeding hens mated up to provide all the replacements in two hatches three weeks apart or, if weekly hatching is carried on, the chicks from three hatches, at the best hatching time of the breed, should be reared separately and compared. This gives a much more accurate comparison than considering all the chicks hatched, as early and late pullets of the same breeding may vary considerably. It is advisable to have at least six pens, as the more males that are tested, the more chance there is of finding outstanding sires.

In the first year it is best to use good pedigree cockerels, preferably sib-tested, from progressive breeders who have been consistently successful at egg laying competitions. They should also be strong in any points in which the flock is weak. In most flocks undersized birds, light eyes and crooked breastbones are common faults.

The eggs from each pen are hatched separately, and the chicks from each pen are given a different toe-punch.

Pen A.	Pen B.	Pen C.	Pen D.	Pen E.	Pen F.
Sire 1 and 12-15 hens	Sire 2 and 12-15 hens	Sire 3 and 12-15 hens	Sire 4 and 12-15 hens	Sire 5 and 12-15 hens	Sire 6 and 12-15 hens

Toe Punch

Records are kept of—

(i) The fertility and hatchability of the eggs from each pen.

(ii) The percentage of cockerels reared to maturity and their quality. At least twelve selected cockerels from each pen must be kept for possible breeding later.

(iii) The percentage of pullets reared to maturity and their quality.

Just before they start laying the pullets of the hatches being compared are sorted out on their toe-punches, and the pullets from each pen are placed in separate laying houses. Only diseased or crippled pullets should be culled, and a note should be made of the percentage culled. Heavy culling must not be done, as this will destroy the accuracy of the comparison.

The number of pullets placed in each house must be recorded, and the daily production of each house must be kept. The earliness of maturity of each pen, the intensity of production through the winter, the percentage of pullets moulting, and the amount of broodiness and the persistency of production can be noted as an average for the pen during the year. The egg size, quality, and colour of shell should be observed. If convenient the food consumption of each house should be kept, as strains vary considerably in the efficiency with which they turn food into eggs.

Mortality is very important, and if possible all birds dying should be sent to the Director of Veterinary Research, P.O. Box 657, Salisbury. Sires whose progeny die from range paralysis or cancers should not be used again, and their progeny should not be used in breeding pens.

A good measure which combines egg production and mortality is to divide the total number of eggs laid by the house for the full year, by the number of pullets originally put into the house.

Second Year. By the beginning of the second breeding season the breeder will have a good idea of the relative merits of the sires he used in the first breeding year. He will know fertility and hatchability, winter intensity, egg size and amount of winter moult of their daughters up to 1st June.

Thus in the second breeding season he will use the two best cocks, basing his estimate on all the above points, and the two best cockerels from each of these sires, and eliminate the worst four cocks. The best breeding pens from the previous year will be used again, divided up again at random, and the pens will be filled up by selected hens which have just finished their first season of laying.

Pen A.	Pen B.	Pen C.	Pen D.	Pen E.	Pen F.
Best Sire and 12-15 hens	Second best sire and 12-15 hens	Sire 7, son of best sire and 12-15 hens	Sire 8, son of best sire and 12-15 hens	Sire 9, son of 2nd best sire and 12-15 hens	Sire 10, son of 2nd best sire and 12-15 hens
Original toe punch	Original toe punch	·⊥⊥·	⊥··⊥	·⊥··⊥	·⊥·⊥·

Third Year. The breeder will carry on in the same way in the third breeding season. This year, however, he will be able to fill up his breeding pens from selected yearling hens which are the progeny of the two best sires used in the first year of breeding. The daughters of the one sire should be mated to sons or grandsons of the other sire to prevent inbreeding.

Fourth Year. The same method will be used, except that as a check, only one cockerel from the second-best sire will be used, and an unrelated cockerel, again from a progressive breeder and if possible sib-tested, should be tested in Pen F. If his progeny is not superior to those of the other sires tested however, he will not be used again. If he proves better, however, he and two of his sons will be used again in the fifth breeding season.

It will be advisable from the fourth year on to test the effect of inbreeding on the strain by introducing an outside bird regularly, especially if hatchability and egg production decline and pullet mortality increases.

This system offers a very sound method of improving production with a minimum of record keeping and no trapnesting. The biggest objections to the scheme are the cost of providing small breeding pens, and the necessity of having the same number of laying houses to accommodate twenty to thirty pullets for testing. The subdivision of ordinary laying houses by wire-netting to provide suitable pens need not prove very expensive, however.

A third objection is the necessity of keeping a considerable number of cockerels until their sisters have proved themselves, but the progeny of obviously inferior sires may be eliminated before June. A large commercial farmer may mate up only a percentage of his birds on this system, and the remainder of the cockerels from the best sires may be used for flock matings or they may be sold to other breeders who wish to make use of these "sister-tested" birds.

6. PEDIGREE BREEDING.

While the above system is very suited to the commercial egg producer, the stud breeder requires more detailed records and an individual pedigree of each bird. This involves considerably more record keeping, but provided it is combined with progeny testing, progress will be made more quickly. Selection of the five inherited characters is more accurate with full records, and progeny testing of the hen as well as the sire will prevent cockerels being used from a hen which gave inferior results with a good sire, which can happen under Dr. Hagedoorn's system.

Pedigree breeding has often failed to produce the results expected from it in the past. One reason is that it has not been sufficiently recognised that total egg production is not inherited as a whole but is due to the inter-action of five different inherited characters. The second reason is that progeny test has not always been used, or that the family records are not summarised at regular intervals to give an accurate progeny test. For instance, one sire may produce a 300-egg daughter, but the

average of all his daughters may be only 180 eggs. Another sire may give no outstanding daughters, but all his daughters may average 210 eggs. Unless the breeder summarises his records, he may be completely led astray by the one 300-egg daughter, and use that sire in preference to the other.

There is no point in a pedigree breeder starting with inferior stock, and the breeder who feels that his own birds are not of sufficiently high quality, will find that it will pay him better to buy day-old chicks or pedigree stock from good breeders. He then starts at a point which the other breeders have reached only after years of breeding. Buying stock from several breeders may help a breeder to combine in his strain the desirable points from each.

Provided the stock is good, some or nearly all of the birds will possess the desirable economic qualities. The breeder now has to try to combine all the desirable qualities in each bird and fix them so that the birds breed true for them. The more characters that are looked for at the same time, the fewer birds will be found possessing them all. Thus the breeder should fix only one or two at a time, being careful to maintain any characters already fixed. Both pedigree records and the progeny test should be used in fixing these characters.

As only one male is needed for every six to fifteen hens, selection of sires on their pedigree and sib-test should be much more stringent than for the hens. Using a considerable number of hens and only mating six to eight hens to a male till he is progeny tested, will allow more males to be tested. Hays and Sanborn found that only 5% of tested males improved production mated to hens with records from 226-250 eggs. At Cedara College of Agriculture only five males out of sixty tested improved production where the hens' records ranged from 200-313 eggs.

High mortality is becoming such an important problem that low mortality and resistance to disease should first be established in the strain. No bird should be used for breeding whose family showed greater mortality than 10% as chicks and 15% in the first laying year. All families in which any member showed range paralysis or cancer should be eliminated. Longevity should always be considered, and records of production should be kept of the full life of each breeding hen, so that hens with good production over a number of years will be emphasised.

Hatchability is another indication of constitutional vigour, as it shows the strength of the embryo, and only males whose dams gave 85% hatchability or better should be used, and as hatchability improves, any breeding hens should be discarded who fail to give 85% hatch of fertile eggs.

It is no use producing eggs that are too weak shelled to be sent to market. At all times only large well-shaped, strong shelled eggs, should be set, and any sires who give weak shelled or small eggs in their progeny should be discarded.

When these characters are fixed, the breeder can proceed to fix the characters responsible for high production.

Early maturity can be fixed first. Preference should be given to breeding hens which matured at 185-215 days in dual purpose breeds and 170-200 days in Leghorns, as they are less likely to be undersized.

Intensity of production should then be fixed, followed by persistency of production.

In dual purpose breeds broodiness should then be bred out as much as possible.

Finally winter pause should be considered, but this is a most difficult character to fix as environment plays such an important part in determining whether a bird will show pause or not. However, both the amount and length of pauses can be reduced considerably, though the improvement may not be consistent, due to differences in climatic conditions from year to year.

The following standards can be used as a basis:—

Maturity	200 days or less for Leghorns	215 days or less for dual purpose breeds
Weight at first egg ...	3½ lb. or more for Leghorns	5 lbs. or more for dual purpose breeds.
Intensity	3 or more eggs per clutch	or 23 eggs per month for two of the three months March, April and May.
No winter pause.		
No broodiness.		
Persistency	300 days or more, preferably 365 days,	or laying on 1st March.
Egg size	Not less than 2⅛ oz. for pullets	or 2¼ oz. for hens.
Egg shape and shell texture	Normal shape eggs	with very good shells.

The breeder will then have fixed all the more important economic qualities, but as his stock improves, he should raise his minimum standards year by year.

He can also then proceed to fix the minor points, such as table qualities and Show points, but these should not be improved at a loss to the more important economic qualities.

Generally speaking, at least 500 birds in a breed are required to give sufficient selection to make a pedigree breeding programme justifiable. Lesser numbers do not give sufficient selection, and do not allow sufficient males to be tested. Progress with smaller numbers can be made, but it will prove much slower and more difficult.

7. KEEPING PEDIGREE RECORDS.

Trapnesting and the keeping of records cost time and money, and unless they are accurate and are studied and summarised regularly, they are of little value. Important points on records are that they should be complete, yet as simple as possible, and give any information required quickly.

The purpose of breeding records should be to answer at least four questions regarding any individual bird which has ever been mated. These questions are:—

(a) What birds are its ancestors and what was their breeding and production?

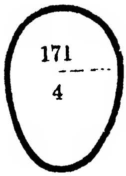
(b) What birds are its brothers and sisters, and, if the information is available, what have been their breeding and production performances?

(c) With what bird or birds is it at present mated, or has it been mated in the past?

(d) What were the results of these matings?

A system of record keeping and the actual record sheets advised are given below. The system is worked out for a breeder who has just started to trapnest and pedigree.

In the first trapnesting year the pullets will be unpedigreed. The breeder will therefore carefully select for trapnesting only those pullets which in vitality, freedom from defects and general physical conformation would be suitable for breeding if their production proves satisfactory. These pullets are then put into a house for trapnesting, before they start laying. They are all banded with consecutively numbered legbands. The band is most convenient to read if it is put on upside down on the right leg. When a hen is trapped and removed from the nest, the egg is marked with her legband number, usually with the pen number below it.



At the end of each day the eggs are sorted out consecutively and entered in the laying record. Some breeders use a monthly egg record sheet, and transfer each bird's production to her own individual egg record sheet at the end of each month. Work is reduced if the eggs are entered directly on the bird's individual egg record sheet daily, and this also allows summarising of any bird's production to date at any time.

Sheet A and reverse. The individual egg record sheet is a cardboard sheet as illustrated below. On the reverse side is the bird's full pedigree and her hatching record. The sheets are kept consecutively according to legband numbers in a box or filing cabinet, and before the eggs are recorded they are sorted consecutively on wooden racks. For convenience these racks should be square and should be bored with ten lines of holes, each line having ten holes. Eggs numbering 1-100 can be sorted on the first rack, 101-200 on the second rack, and so on. All eggs may be weighed, or only the first ten eggs from each pullet, and then all eggs laid in August, to get an average annual egg weight.

As each inherited character can be identified, this can be entered in the space provided for it on the sheet. Maturity will not be known for these pullets, however, unless they were all hatched the same date.

At the end of the year the breeder will keep for breeding those birds still showing high vitality, and the desirable characters in their records. The first year record is taken from the first egg to 365th day following. Another laying sheet will be opened for the second laying season and the first year record filed. The record sheets of pullets not retained for breeding can be destroyed as they are of no further value to the breeder.

Sheet D and reverse. The breeder will now be able to make up matings with birds of known production records. For the first year he will probably use pedigreed cockerels which he has purchased. A record must be kept of all the matings made, and a suitable mating record is illustrated in fig. 4.

During the incubating season the eggs from the breeding pens will be collected and stored for hatching. Where eggs are set weekly, there is no need to turn them. The eggs from each hen can be stored in a cabinet which has trays bored for seven eggs in each line, the number of lines depending on the width of the tray. One line is kept for each hen and her number can be entered on a card on the front of the tray.

Before setting, the eggs from each hen should be compared. If an egg is found that is noticeably different from other eggs of the same hen, the error must have occurred in trapnesting. Such an egg should be discarded, or the number scratched out, so that only the pen number is left. Thus the chick from it will be recorded as the offspring of the sire only, with an unknown dam. This is why the pen number should be marked on the egg as well as the hen's number. It also serves as a check whether any hen has by mistake got into another pen.

Incubating is done in the usual way up to the eighteenth day, except that all eggs from one hen are put in the same tray, for ease in sorting later. Instead of testing on the seventh and fourteenth days, it is better to test on the seventh and eighteenth days, as fertile eggs dying between the fourteenth and eighteenth day will not need to be put in the pedigree baskets or bags.

On the eighteenth day all the eggs of one hen are put into a separate mosquito netting bag or pedigree cage. The latter is usually made of gauze or woven wire mesh, and individual baskets may be used, or preferably a large one, with sub-divisions, and made to fit the hatching trays can be used. There must be no possibility of chicks escaping from these pedigree bags or baskets after hatching. Where two or three breeds are kept, eggs from hens of different breeds can be put in the same basket, as the different chicks can be identified and less baskets are required.

In each basket a slip of paper should be placed with the hen's number and number of eggs put in.

Sheet B. A record should be kept of the hatching results of each hen's eggs for each hatch, and this should be summarised for the season. For each hatch a rough sheet for all the hens can be used, and the results transferred to each hen's individual hatching record on the reverse of her egg record sheet when the hatch is completed. The rough record is illustrated in fig. 2. An individual record is also used for each sire, the season's results for each hen being entered on line for each, and a summary made of his results. The reverse side of an egg record sheet is suitable, his pedigree also being entered.

After the hatch is over, the next step is to mark the chickens. This is done by placing a numbered wingband in the wing as the chicks are removed from the pedigree basket. The band is inserted in the web of skin on the leading edge of the wing in front of the elbow joint. Great care must be taken to insert the band only through the web of the skin, as if put in too deeply the muscles of the wing may be caught. There are many kinds of wingbands, but the main points are that they should be quick to insert, and not likely to work loose, as the wingband remains the pedigree identification of the chick for life.

The wingbands are numbered serially and, as the chick is banded, the number of the hen, as indicated by the paper slip and checked by the number on the egg shells, is entered against the wingband. The sire's number is entered from the mating record later.

Sheet C. The chick index form is shown in figure 3. It is the only form on which birds of different breeds are entered together. All other records should be kept separate for each breed to make it easier in consulting records.

Further details are entered on the chick index record later, such as which chicks are male ♂ and which female ♀ their weight at six weeks, rate of feathering at 6 weeks + for fast, — for slow, and any faults. When any chicks die, the wingbands are removed and death entered in the chick index in red ink, with cause of death if known. This is a valuable check for summarising chick mortality in different families later. When the cockerels are sorted, the chick index book is used to find their pedigree, and the reasons for culling any should be entered, as this gives an indication of the faults shown by the various families.

Fig. 1. Sheet "A"

HEN No. ....

Sire .... **BREED** .... Hatched .... Intensity

W.B. 1st Egg .... Last Egg

Dam .... 19...... to 19...... Age 1st Egg .... Persistency

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total	A	B	C	Total Weight	Ave. Wgt.		
December ..																																							
January .																																							
February .																																							
March																																							
April																																							
May																																							
June																																							
July																																							
August																																							
September ..																																							
October																																							
November ..																																							
December ..																																							
January																																							
February .																																							
March																																							
April																																							
May ...																																							

Body weight 1st egg .... **Av. egg wt. first 10** .... **Shell colour** .... **Eye colour** ....

Body weight 1st Sept. .... **Av. egg wt. August** .... **Shell texture** .... **Pupil** ....

HEN No. ....

Male	Hatch No.	Date Hatched	Set.	Inf.	D^1	D^2	D.S.	K. Crp.	H.

% Fertility .. % Hatchability ....

PEDIGREE

Av. Production

Full sisters

Full and half sisters

Daughters

Mortality

Full sisters

Full and half sisters

Daughters

REMARKS

Fig. 2. Sheet "B"

HATCHING RECORD.

Setting No.................... Incubator No....................

Date Set.	Hatching Date.	Hen No.	No. of Eggs set.	Unfertile.	Dead Germs.		Dead in Shell.	Cripples.	No. Hatched.
					1st Test.	2nd Test.			

Fig. 3. Sheet "C"

CHICK INDEX

EXPERIMENTAL STATION

POULTRY DEPARTMENT.

Numbers .... to ....

Date Hatched ....

Numbers .... to ....

Date Hatched ....

Wing Band No.	Dam	Sire	Sex	Wt. at 6 Weeks	Feathering	Breed	NOTES

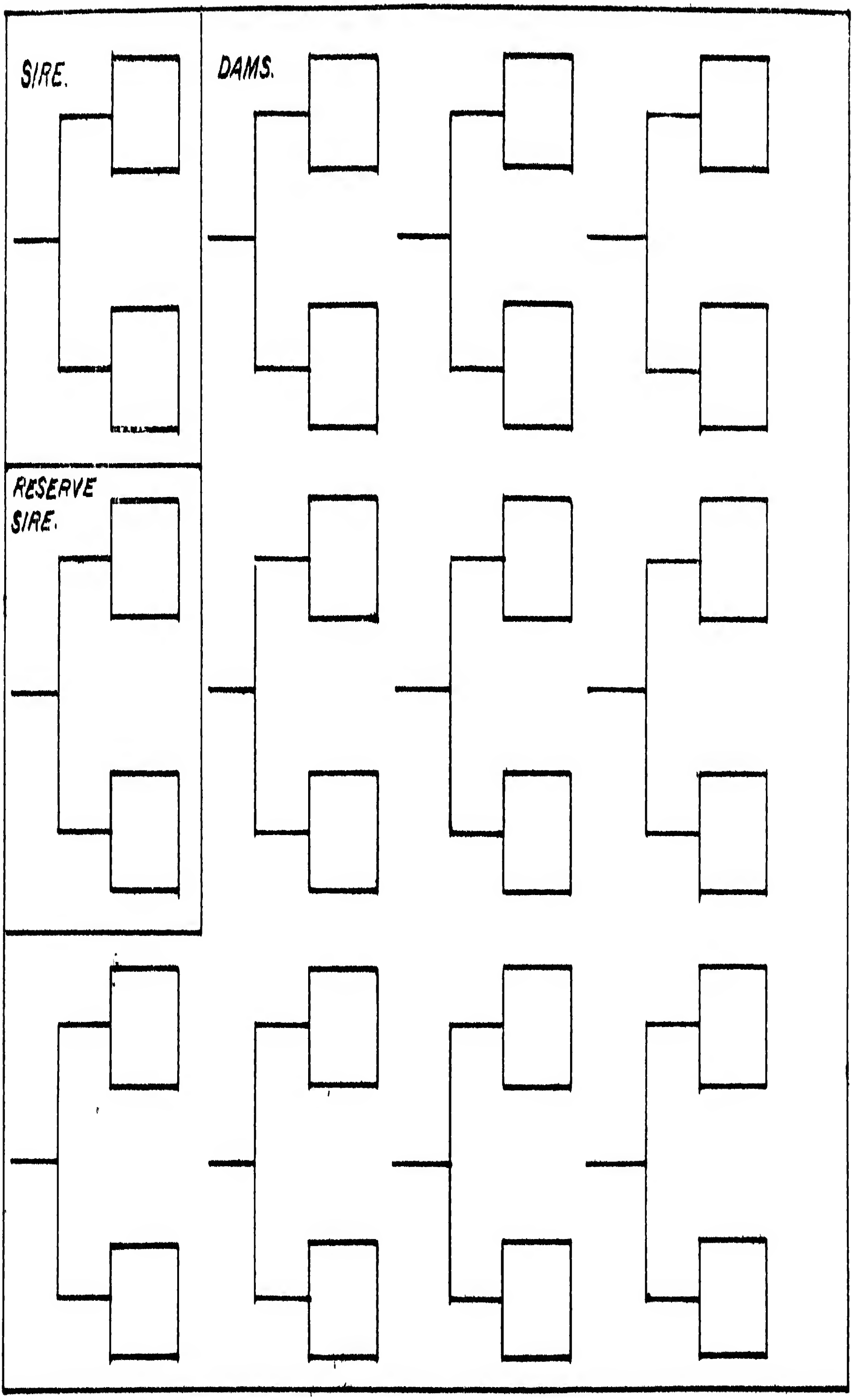
POULTRY DEPARTMENT.

Fig. 4. Sheet "D"

House No. .... Breeding Season . . . .

					MATING		
♂	Mating Dam x Sire	♀	Mating Dam x Sire	Egg Records	♀	Mating Dam x Sire	Egg Records
Reserves							

NOTES: ....


SIRE.
DAMS.
RESERVE SIRE.

As the pullets come from known parents, they are used for progeny testing their parents, and only diseased or crippled birds should be culled. If, however, the progeny from a particular sire show very high mortality or a large percentage of poor birds, then all of that family can be culled, thus reducing the amount of trapnesting and further recording. Cull the whole family however, do not trapnest 10% of the best.

A good system of obtaining weight at first egg and observing faults is to house the pullets before laying, without legbanding them. The first time a pullet without a legband is trapnested it is brought to the recording office, where it is weighed and a legband put on. It can also be examined for eye colour and faults at the same time. The same system of egg recording and entering of the inherited characteristics is practised as in the first year.

This year a progeny test record must be made as the results of each mating become known. This should be started after all the pullets have come into the lay, but should be up to date by 1st June, so that a partial progeny test of the cockerels is available to help in selecting them before they are mated.

The progeny test record is the most important record of all, as it summarises all the results of the other records, and should always be brought up to date as further information becomes available.

The progeny test summary record can be a large printed sheet on the loose leaf principle, or a well-bound foolscap size book can be used for a number of years. A double page can be ruled in suitable vertical columns. The columns suggested are the following, in that order, but more or less detail can be entered as the breeder wishes.

Legband	Wingband	Dam	Sire	Hatched	Body wt.			Egg wt.		Days to first egg.
					6 weeks	1st Egg	1st Sept.	1st 10	Av. Aug.	

Intensity	Pauses in days		Times broody	Date of last egg.	Days in lay.	Egg production 365 days	Shell quality.	Shell colour.
	Winter	Summer						

Eye colour.	Body Shape.	Rate of feathering.	Remarks.

When all the pullets have started laying, the individual record cards are sorted out, first according to the sires, and then according to the dams with which that sire was mated. All the progeny of one sire is entered together, keeping the progeny of each dam together. For convenience it is best to start with the progeny from the dam with the lowest legband number first. The progeny are entered on the record, one line for each, in order of their hatching date When all a dam's progeny are entered, they are ruled off and the next line left for the average of her progeny, and the average ruled off with a red line. The progeny of the next dam are entered below, and so on. When all the progeny of one sire have been entered, a double line is drawn and a line left for the average of the sire's progeny to be worked out. This is ruled off with a double red line, and the progeny of the next sire continued below.

Most of the particulars of each pullet will be available from her individual egg record sheet, but body weight at six weeks and rate of feathering, if noted, will be available from the chick index book, by looking up the wingband number. In light breeds the first few eggs show most tinting if it is present, and this should be noted then. Shell quality is poorest at the end of the laying year, and should be noted in December. Eye colour can be entered in pencil when the pullet starts laying. The record of a pullet which dies may otherwise be lost, but the eye colour retained at the end of the season is more important, and should be entered in ink at the end of the year, when the birds are selected for breeding.

All other particulars will be entered in the remarks column, which should be fairly wide. The death of a bird is recorded here, and cause of death. Any other points such as slightly crooked breastbone, highly nervous temperament, white in lobe in red earlobe breeds, and white on face in Leghorns can also be noted down against any pullet.

On the line giving the average of a dam's progeny, the dam's hatchability and the mortality of her chicks should be entered in the remarks column. The average hatchability of all dams and mortality of all chicks of one sire should be entered in the same column on the sire's average line.

Thus all the records of the results of a mating are collected together in the progeny test record. As all the characters are averaged, the sires can be compared for any particular character, and the results of each dam with a certain sire can also be compared. This enables the breeder to select superior individuals from superior matings for use as breeders. The breeder is also helped in mating up by knowing in what respects certain families are weak, and he can mate such birds up to families which are strong in these particular respects.

In recording production for 365 days, the number of eggs laid for that period, or up to the time of death in the case of a bird which dies, should be entered. The total number of eggs laid by a family should be divided by the number of pullets which started the laying year. The average production of the family then reflects

the mortality as well as the egg production, and is a truer indication of its worth than the average of the surviving birds.

That correct pedigree breeding with progeny testing will achieve very high results is shown in the 1945/1946 Annual Report of the Canadian Record of Performance. The Experimental Farm at Kentville, Nova Scotia, with twelve years work in R.O.P. breeding entered 595 White Leghorn pullets out of 600 on the farm. 574 pullets of the 595 laid more than 200 eggs, and the average production of all 595 pullets was 249 eggs with an average weight of 2-3/16th oz. Only 4% of the pullets died or failed to reach 200 eggs. Twelve superior progeny tested sires and 63 progeny tested dams were proved in testing the pullets. The highest sire gave 60 daughters which averaged 265 eggs and one hen with him gave seven daughters which averaged 297 eggs.

In conclusion, it is hoped that all breeders will be able to make use of some, if not all, of the information contained in this article. Each breeder can adapt the latest advances in breeding knowledge to his own particular requirements. The main factors, however, are that in the first place good birds from good families should be selected as breeders, and they should themselves be progeny tested in turn. This offers the only certain means of obtaining consistent improvement by breeding.

Agricultural cleanliness is often the shortest distance between failure and success.

WHY FARM IN CIRCLES ?

Cleanliness Aids Insect Control.

Buildings for Virginia Type Flue-Cured Tobacco

By B. G. GUNDRY, Agricultural Engineer, in collaboration with D. D. BROWN, Chief Tobacco Officer and Chairman, Tobacco Research Board.

1. LAY-OUT OF BUILDINGS.

The lay-out of a group of tobacco buildings is largely a matter of personal preference. Experienced growers differ considerably on the subject according to their particular circumstances, the handling routine adopted and the relative importance they attach to the different factors which have to be considered. Figure 1 shows the general type of lay-out favoured by the Chief Tobacco Officer as a sound and practical arrangement. As will be seen, the buildings for each purpose are separated from each other and can be added to or altered as circumstances warrant with the minimum amount of inconvenience. When planning a lay-out it should be remembered that the windows of the grading shed must face south.

2. FIRE RISKS AND INSURANCE.

The matter of fire risks is one which must be fully considered when the lay-out of the buildings is being planned. The fire insurance premium on the barns themselves is, at the time of writing, approximately 15/- per £100 per annum for an average curing period of four months. Whereas, the premium payable on other buildings, such as grading and bulking sheds, when separated from the nearest barn by what is generally considered the minimum safe distance of 20 feet, is only 3/- per £100 per annum. If, however, such buildings are attached to any barn or are erected within a distance of 20 feet therefrom, the higher rate payable on the barn is also charged on all such buildings.

The risk of fire spreading from a barn to an adjoining structure is a very real one, and it must be remembered that the insurance premiums quoted above cover only the value of the buildings themselves, and not the possible loss of revenue which may result from the destruction of the buildings. Such loss may be considerable, and can only be covered by a separate policy.

A reference to the matter of barn fires is made in Section 5.

3. FLUE-CURING TOBACCO BARNS 16 ft. x 16 ft. and 16 ft. x 20 ft.

The general construction and details of the orthodox 16 ft. x 16 ft. flue-curing barn is shown in Figure 2. This drawing shows the barns equipped with flat or lean-to roofs. The adoption of

this type of roof in recent years is largely the result of the shortage of roofing materials and the fact that it is far easier to construct than the gable roof, particularly when gum poles or other unsawn timbers have to be used.

Barns fitted with such roofs and provided with adequate ventilators placed in the walls immediately below the roofs, are reported to give quite satisfactory results. There is, however, little doubt that the gable roof, particulars of which are shown in Figure 3, should, from purely theoretical considerations, prove superior, but no evidence to confirm or refute this theory has been brought to the notice of the writer.

Advice of a general nature regarding the building of the barns is given in Section 14. As mentioned therein, the foundations should be laid in lime or cement mortar, but the walls above the damp course may be laid either in lime mortar, which is recommended, or dagga. If dagga is used, the external joints should be raked out to a depth of ¾ in., as the bricklaying proceeds, and later pointed with lime or cement mortar. If the building is not pointed throughout, the chimney itself and about 2 ft. of the wall on either side of it should be pointed in order to preserve the bonding between the wall and chimney and to maintain the latter in an air-tight condition. The chimney, if of brickwork, must be securely bonded to the wall by each alternate course of brickwork to ensure that it will remain secure and air-tight. The flue is, as a rule, made either 9 ins. or 14 ins. square; the former is usually found quite adequate if kept free from heavy deposits of soot, whereas the latter, through being unnecessarily large, may not induce such a good draught. It is suggested, therefore, that as a convenient compromise, it should be made 9 ins. x 14 ins. The flue is sometimes recessed into the wall itself, as shown in the general views in Figure 2, but it is more generally built clear of the wall, as indicated in the inset plan. This is probably the more satisfactory method, as it does not then weaken the wall, and the number of additional bricks required is negligible. Moreover, it leaves a wider support for the central roof truss or rafter, and provides a greater thickness of brickwork between the flue and the ends of the centre tier poles. The brickwork of the chimney may be either 4½ ins. or 9 ins. thick. If the bricks are hard, sound and properly bonded, the former should be quite satisfactory, but with relatively soft bricks it would be advisable to make at least the lower half 9 ins. thick.

Tubular chimneys made of galvanised sheet iron and usually 11 ins. in diameter were quite popular in pre-war days when such material was readily available. Their use eliminates most of the complicated brick construction where the furnaces are connected to the flues, and also the job of fitting the flashing where the brick chimney passes the roof.

The vents for the admission of fresh air into the bottom of the barn are usually four in number, two in the front and two in the back wall. These should be approximately 12 ins. square and may be fitted with sliding shutters of sheet iron or timber, as indicated in the drawing of the "Townsend" barn (Figure 11). A cheap but rather clumsy alternative method of controlling the

amount of air admitted is to adjust the size of the opening by inserting loose bricks.

The floors of the barns should be of brick, laid flat and grouted and plastered with 1-4 cement plaster. If the floors are left of bare earth or unplastered brick and are kept very wet during the colouring process, the evaporation of the residual moisture cannot be controlled, and may delay the subsequent drying out of the leaf.

The tier poles should project 4½ ins. into the walls at each end, and it is more convenient to build them in as the walls are built than to insert them at a later stage. The corbelled brick ledges sometimes built into the end and division walls to support the tobacco sticks are satisfactory only if the bricks used are really hard. Soft bricks soon wear and crumble away.

The roof covering may be of corrugated asbestos, as indicated in the drawing, or of corrugated iron or aluminium. The distance between the purlins should not exceed 4 ft. 6 ins., and must be adjusted to suit the length of the roofing sheets.

A separate drawing of 16ft. x 20 ft. barns has not been included with the illustrations, since these differ from the 16 ft. x 16 ft. barns only in regard to the dimensions of the floor plan, and certain details, the required alterations to which are fairly obvious. It is usually considered more convenient to increase the width rather than the depth from 16 ft. to 20 ft. and thus retain the same roof span. One extra rafter, or, in the case of a gable roof, a roof truss, will be required. The number of bottom air inlet vents may, with advantage, be increased from two to four in each wall in order to obtain a better distribution of the ingoing air. It is, of course, important that the full length of flue pipe which the larger barn will accommodate should be installed to provide the maximum radiating surface.

In a flat-roofed barn the length of each of the four outlet ventilator openings should be increased from 5 ft. 6 ins. to 6 ft. 6ins., with a corresponding increase in the length of the flaps, and the distance between openings should be increased from 3 ft. to 3 ft. 6 ins.

Details of gable roofs and two types of ridge ventilators for 16 ft. x 16 ft. and 16 ft. x 20 ft. barns are shown in Figures 3, 4 and 5. It will be noted that the pitch of the roof is such, that roofing sheets 9 ft. long may be used opposite the ventilators, and sheets 10 ft. long for the remainder of the roof without the necessity for cutting them. It must be appreciated, however, that if the external dimension across the barn is increased beyond the correct figure of 18 ft. 4 ins., such sheets will be too short.

It is, of course, very advisable to fit all barns with eaves gutters whether they be equipped with flat or gable roofs. If for any reason this cannot be done, the roof should be extended to overhang the walls by 12 ins. or 18 ins. A shallow gutter at least 27 ins. wide should then be constructed of brick and cement at the foot of the walls, below the ant course, to help to prevent drippings from the roof saturating the ground in the vicinity of the foundations. These gutters should have a slope of 1 in 100 and should be arranged to carry the water well clear of the barns

and other buildings. This arrangement is not nearly as satisfactory or effective as the orthodox eaves gutter, and is recommended only as a temporary expedient to help in preserving the stability of the buildings.

Quantities of Materials. The quantities of materials required in the brickwork of a block of four barns are given below. The quantities of roofing materials, etc., will depend on the type of roof and ventilators to be installed, and these can be readily computed from the drawings of the various alternative designs shown.

Material	Quantity Required: 4 Barns 16 ft. x 16 ft.	Quantity Required: 4 Barns 20 ft. x 16 ft.
Bricks:		
Foundations	10,000	11,600
Walls	75,000	86,000
Floors	3,500	4,300
Lime for laying Foundations	13 bags	15 bags
Lime for laying Walls	75 bags	86 bags
Cement for plastering floors and damp - course screed, etc.	10 bags	12 bags
Damp course, Felt 3 ft. wide	115 feet	130 feet
Alternative:		
Damp course, 26 G.Gal. iron sheets 6 ft. x 3 ft.	20 sheets	23 sheets

Note: (1) The numbers of bricks given above are nett, and no allowance has been made for wastage.
(2) One bag of cement is equivalent to two pockets.

4. THE "TOWNSEND" BARN.

Through the courtesy of the designer, Mr. V. R. Townsend, we are able to publish full details of his barn and furnace, some particulars of which were published in "Vuka" some time ago. Details of the construction of the barn are shown in Figures 11 and 12, and those of the furnaces in Figure 10.

In writing about the barn, Mr. Townsend says: "In designing this barn the limiting factor was that no material should be used other than would be used in the construction of the ordinary conventional type of barn, the only difference being in the number of bricks—30,000 as against 25,000 used in the ordinary barn.

"The objects aimed at were: (1) to maintain an even temperature throughout the barn at all stages of curing; (2) to ensure free circulation of air through the tobacco, irrespective of the degree of ventilation and stage of curing; and (3) to eliminate any direct contact of cold ventilating air with the tobacco.

"In the accompanying drawings it will be seen that the flues lie in brick troughs. Air passages in the walls and under the floors allow air to flow freely from the top of the barn into these troughs, where it is re-heated before again entering the barn. In theory, the air in contact with the hot flue in the trough rises on becoming heated, being replaced by the cooler air from the top of the barn which enters the bottom of the trough by way of the air passages in the walls and floor. Thus the total air content of the barn is kept in circulation, the warm air passing up through the tobacco and descending through the walls, to be re-heated as it passes round the flues. Bottom ventilating air is admitted to the air passages under the floor, so that before coming in contact with the tobacco it is heated by coming into direct contact with the hot flues.

"In practice it was found that at a temperature of 110 degrees F. with no ventilation, there was no appreciable difference of temperature between the top and bottom of the barn. At 140 degrees F. with full top ventilation and half bottom ventilation there was a difference of 8 degrees F. There was practically no condensation of moisture on the leaf in the upper tiers, for the reason that the temperature was more even, although condensation on the roof itself was still apparent. The maintenance of humidity was facilitated for the same reason, and on account of the fact that the air was in circulation.

"Two of these barns were erected on Mr. T. J. Lilford's farm in 1944, and were used in rotation with 12 ordinary barns. During the previous two seasons the incidence of barn rot on this farm was considerable, but it was found that the tobacco cured in these two barns, while not being entirely free, had so much less barn rot than that cured in the ordinary barns that the comparison was striking. These barns also cured out more quickly than the others; a saving of two days per curing was effected in most cases."

The principle on which this barn is designed to operate is, in theory, undoubtedly a very sound one, and it would appear from the evidence available that in practice it is, at least in the directions indicated, a marked improvement on the more orthodox type of barn.

Construction. The important feature in the construction of these barns is the bonding of the hollow walls in which the vertical air shafts are formed. It must be understood that in order to facilitate the building of them, it is necessary that they should be built with the prescribed number of bricks, arranged or bonded in the manner shown in the various views illustrated in the drawing (Figure 11), and not to the nominal internal dimension of 16 feet. It is strongly recommended, therefore, that the exact length which they will be when built, with the particular stock of bricks to be used, should be determined in advance, as explained hereunder, since this dimension will be required before the foundations can be commenced. A single course of bricks, taken at random from stock, should be laid out on a level surface exactly as shown in Figure B, which is a plan view of the course marked "a" in Figure A. A space of ½ inch, equivalent to the ordinary mortar joint, must be left between all the bricks. When this has been completed, it can be measured accurately, and if the bricks are of the usual standard size, the length, corresponding

to the internal depth of the barn, should be approximately 16 feet. If, however, it is found to be several inches longer or shorter, it will not matter, apart from the fact that the dimensions of the roof will have to be adjusted to correspond to the over-all dimension. If it is found that the actual internal dimension exceeds the nominal dimension of 16 feet by less than, say, 2½ ins., it would be advisable to readjust the bricks so that the correct length is obtained, by slightly reducing the width of all the joints, but the adjustment of an appreciably larger difference should not be attempted in this way, since if the joints are reduced to under about ⅜ in., considerable difficulty may be experienced in maintaining such thin joints throughout the full height of the walls, and there might be a tendency for them to spread out towards the top.

When the exact length of the walls, as they are to be built, has been determined, the foundations can be set out and built to correspond thereto. The length of the barns can be made exactly 16 ft., as there is no difficulty in adjusting the length of the front and rear 14-in. walls by closers cut as required.

The foundations, which must extend down to a uniform and compact formation, should be carried up to a height of at least 3 ins. above the surrounding cleared ground level, and finished off with a ½ in. screed of 1-4 cement mortar. A damp course of bituminous felt or galvanised iron should then be laid in the ordinary way. Unfortunately, this damp course may prove of little value in excluding white ants, which will be able to work up through the floor. It would therefore be very advisable to include a second course of felt or iron on a level with the surface of the floor, more particularly in the front wall, where it will serve to preserve the door frames.

The foundations must be laid in lime mortar, with or without an admixture of cement, as mentioned in Section 14, and it is very strongly recommended that the walls of these barns should be laid in lime mortar throughout, in order to ensure adequate strength, and particularly since it is practically impossible to exclude white ants from the cavity walls by means of an effective damp course.

The cavity walls should be laid exactly as shown in the drawing, the two courses "a" and "b" being laid alternately. The arrangement of closers shown at the corners in course "b" is necessary to maintain the correct bond, and if these are altered or omitted, continuous vertical joints will occur and seriously weaken the structure.

The front and rear walls, which are 14 ins. thick, should be laid in "English" bond, which is indicated in Fig. D, which also shows the proper way of bonding in the intermediate cavity walls. In order to ensure the proper bonding of the brickwork, these junctions should be laid first, and any break in the bond of the 14-in. walls made good with closers at some intermediate point.

It will probably be found most convenient to complete all the walls before proceeding to build the horizontal flue passages under the floors. Before these are commenced, the earth floors should be raised, by infilling with compactable soil, to a height of 3 ins.

above the surrounding ground level. They must be tamped until sufficiently hard and finished with a smooth level surface. The hollow brick piers which form the horizontal air passages and also support the floor are built of 4½-in. brickwork, three courses high, laid in lime mortar. They are subsequently filled with soil, which must be carefully tamped until it is sufficiently firm to support the floor. The piers are completely covered by two layers of bricks laid flat, in which openings or ports 9 ins. long by 3 ins. wide are formed, as shown in the plan, to admit air from the horizontal passages into the flue channels or troughs.

The flue channels are 14 ins. wide to accommodate 11-in. diameter flues, and are 6 courses high. If the flues are to be covered with wire netting, and it is recommended that they should be, the netting can be supported by light iron cross-pieces, such as may be made from fencing droppers, cut to a length of about 20 ins., resting on the fifth course of these walls and spaced about 2 ft. apart. Small recesses should be left when laying the top course to accommodate these cross-pieces so that they can then be laid in position and removed when necessary.

When the flue channels have been completed, the spaces between them may be filled in with soil, which should be placed in thin layers, each of which should be carefully compacted before the next is placed. The brick floor can then be laid flush with the top of the flue channels.

Figure 12 shows a block of four barns cut away to indicate the construction of the various special features embodied in the design. It will be obvious that a small flight of steps will be required at each door, but these are not shown in this drawing. The tee pieces for the outlets of the flues could be more easily constructed to the pattern shown in Figure 11 than that indicated pictorially in Figure 12.

When the flues are installed, they should be supported at intervals of from 3 to 4 ft. by bricks placed on edge so that they lie about 4½ ins. above the bottom of the channels.

The flue system should function in the same way as that in barns of orthodox design, as explained in Section 6, and the necessity for maintaining them in a reasonably air-tight condition is equally important.

The ridge-type ventilator shown in Figure 11 may be considered by some to be rather on the small side, in which case either of the ventilators shown in Figures 4 and 5 might be substituted, if preferred, without in any way detracting from the efficiency of these barns.

The advisability of extending the division walls through the roof as a more reliable method of preventing the spread of fire is referred to in Section 5.

Details of the "Townsend" furnace are given in Section 10.

Quantities of Materials. The number of bricks, etc., required for the construction of a block of 4 "Townsend" barns 16 ft. x 16 ft. are as follows:—

Materials	Quantity Required for 4 Barns 16ft. x 16 ft.
Bricks:	
Foundations	11,000
Walls, floors and flue	
Channels, etc.	98,000
Lime:	
For laying foundations	14 bags
For laying walls, etc.	98 bags
Cement for damp course screed	2 bags
Damp course felt, 3 ft. wide	150 feet
Alternative:	
Damp course, 26 G.Gal. iron sheets 6 ft. x 3 ft.	28

Note: The numbers of bricks given above are nett, and no allowance has been made for wastage.

5. **BARN FIRES.**

Before leaving the subject of barn construction, the matter of barn fires will be dealt with.

The most common cause of barn fires is believed to be due to a stick of tobacco falling on to a hot flue and becoming ignited. The obvious precautions are, therefore, to reduce, as far as possible, the chances of the sticks falling and to cover the flue where it is liable to become dangerously hot. The sticks should be straight and of sufficient thickness to ensure that they will not bend and slip between the tiers. They should, of course, be long enough to span the tiers with a good margin to spare. It is a wise precaution to see, when the barns are being built, that all the tier poles are evenly spaced, not only in each barn, but throughout the whole block, so that when the sticks are cut to a uniform length they can be used safely in any position in any barn.

It is strongly recommended that the inlet flue should be guarded for a distance of not less than 6 ft. by wire netting held by metal supports at a height of 2 ft. above the flue. The wire netting should be at least 3 ft. wide, with a mesh of 1 in. or smaller. All loose tobacco and other inflammable debris should be removed during and between curings. The height of the lowest tier poles should be at least 6 ft. 6 ins. from the floor.

In order to prevent the spread of fire from one barn to another, the division walls between the barns should be carried up at least 9 ins. above the roof, as shown in Figures 2 and 3. No purlins or other timber should pass over or through these walls. It will be noted that in Figure 11, which shows the "Townsend" barn, although the purlins stop short at the division walls, the brickwork does not project above the roof. While this method of

construction is a partial protection against the spread of fire, it cannot, as Mr. Townsend admits, be considered as reliable as the more orthodox construction recommended.

The centre tier poles which come opposite the chimney should project into the wall for a distance of 4½ ins. only, so that there is 9 ins. of solid brickwork between the chimney flue and the end of the poles. No roofing timbers should project into the brickwork of the chimney, for, although normally the flue gases would not be sufficiently hot to ignite them, there is always a danger of the soot in the chimney catching fire.

In the event of an outbreak of fire in a barn, the following procedure should be followed, as far as circumstances permit, and it is as well to instruct the barn boys accordingly, so that in an emergency they will not waste precious time looking for "the boss" should he be absent at the time. If a stick of tobacco is seen, by chance, to fall and catch fire, the obvious course is to remove it from the barn carefully, but quickly, before any other leaves become ignited. Once the fire has spread to the bulk of the tobacco, the door and all ventilators, both top and bottom, should be closed immediately and made as air-tight as possible. If bricks are used to close the bottom vents, they should be quickly sealed over with dagga to make them quite air-tight, and any gaps under or round the door should be sealed in the same way. All air inlets to the furnace should be closed as effectively as possible. If these measures to exclude air are taken promptly, as soon as the fire is discovered, it is probable that the fire will die out for want of oxygen, and damage will be restricted to a minimum. The barn should be kept sealed for several hours to ensure that all smouldering material is extinguished.

6. THE BARN HEATING SYSTEM.

The ordinary barn heating system consists of a furnace designed to burn wood or coal, a set of flues and a chimney. Of these it might be said that the flues are the most important and generally the most abused and neglected item. The simple physical principle on which the system is designed to work is, briefly, as follows:—Hot air, per unit of volume, is lighter than cold air, and therefore the column of hot air in the chimney tends to rise. The velocity with which it moves upwards depends largely on the difference between the temperature of the air inside and outside the chimney, and, within limits, the height of the chimney itself. As this hot air—which is, in actual fact, a mixture of the various gases produced by the combustion of the fuel—rises in the chimney, it draws in more hot air from the flues, and this is in turn replaced by fresh air drawn through, and at the same time heated, by the burning fuel in the furnace. Thus a continuous flow of air is maintained through the furnace, flues and chimney. It will be seen, therefore, that the system depends primarily on the suction or draught induced by the hot air rising in the chimney, and not by pressure from the furnace.

In order to maintain this circulation of the air, the whole flue system from the furnace to the upper part of the chimney must be installed and maintained in a reasonably air-tight condition, since it is evident that if the circuit is broken by an appre-

ciable leakage of cold air into the flues or chimney, the hot air therein will be cooled and the draught at the furnace decreased in proportion to the extent of the leakage. In extreme cases, where bad leaks have developed in the flues through holes, usually caused by rusting of the iron or badly made joints, or through dagga having shrunk and fallen out of the joints in brick junction boxes, the system has failed completely, owing to there being insufficient draught at the furnace to maintain the fire. In other cases the sluggish burning of the fire due to insufficient draught, combined with a small inflow of cold air direct into the flues, has made it impossible to heat the barn to anything like the required temperature.

If the chimney has not been securely bonded to the barn wall, serious leaks may develop in the vertical joints between the two, either through the chimney tending to break away from the wall or through the dagga mortar being washed out of the joints by rain. In either case the draught up the chimney may be seriously decreased, and any open joints should be filled with dagga, or, preferably, lime mortar. If there is an excessive drop in the temperature between the inlet and outlet flues it will usually be found that there are one or more bad leaks somewhere in the flues. An inadequate draught at the furnace, or the bad practice of leaving the fire door open, which is referred to later, will result in the incomplete combustion of the fuel, which in turn will lead to an excessive deposition of soot and tar on the inside of the flues, which will greatly reduce their efficiency as radiators.

In every case of heating difficulties investigated by the writer, the trouble has been due to defects in the flues or chimney and not in the furnace.

No furnaces, however well designed and built, can work efficiently unless it is operated intelligently in conjunction with an adequate and sound set of flues and a chimney of suitable cross-section and sufficient height. Nor can the performance of one furnace be compared with that of another unless both are used in conjunction with flues and chimneys of similar design, length and condition.

The temperature of the flues and barn is controlled by two factors: the depth of the fuel bed and the amount of air permitted to flow through the burning fuel, which in turn controls the rate at which the fuel is consumed. In all well designed furnaces provision is made for controlling the inflow of air to the ash pit. This control must be exercised intelligently if a steady temperature and an economical consumption of fuel is to be maintained. A common fault of the average native is to overload the furnace, and then, when the temperature begins to rise above the prescribed figure, to open the fire door wide. The correct procedure is to maintain a uniform depth of fuel appropriate to the temperature required and control the rate of burning by regulating the air admitted to the fire by the ash pit door grid, or, in the case of the "Gundry" furnace, regulating the size of the air inlet openings in the sides of the furnace with loose bricks.

7. TOBACCO FURNACES.

In addition to the furnaces referred to in detail hereunder, there are a number of proprietary furnaces, made by local manufacturers, which are designed to burn either wood or coal, or both these fuels. The essential features of such furnaces consist of a cast-iron front fitted with fire-box and as pit doors and a set of fire bars and their supports. The ash pit door is fitted with an air regulator for controlling the amount of air entering the furnace. By the proper manipulation of this air regulator, together with judicious stoking, the required temperature of the barn can be maintained within satisfactory limits of accuracy and fuel consumption kept at a minimum.

Little difficulty is encountered when operating such furnaces with wood fuel, but very careful and judicious management is required in the use of coal if good and economical results are to be obtained.

8. THE MANAGEMENT OF COAL-BURNING FURNACES.

The general procedure which should be adopted in the stoking of a coal fire is briefly as follows:—

When working at medium or high temperatures, the grate must be kept completely covered with a uniform layer of coal, which should not exceed about 4 ins. in thickness. As soon as the fuel has burnt to a bright, flameless glow, the fire should be re-stoked, but before fresh coal is added, the entire bed must be well stirred by pushing the slice right under it repeatedly until the fuel has all been lifted off the fire bars and any coagulated lumps have been broken up. The loose ash will fall through the fire bars while this is being done. The fuel should then be raked to an even layer through which the air can pass freely. One, or at most, two shovelsful of coal may then be added and spread in a uniform layer all over the bed. The furnace door should then be shut and kept closed until the fire has to be stoked again, but the regulator in the ash pit door should be opened fully for a few minutes, to reduce the smoking period as much as possible. As soon as the new coal is burning freely, the regulator should be partially closed to regulate the rate of burning as required. If the fire is allowed to cool down too much before re-stoking, or if too much coal is added at one time, the recovery period will be unduly prolonged, the temperature of the barn will drop, and an excessive amount of soot and tar will be deposited in the flues. The golden rule is therefore to stoke little and often.

When a small fire is to be maintained at the commencement of a curing, a low bank of coal may be formed at the front end of the grate, while a thin even layer is spread beyond it. This has the effect of reducing the area of the more actively burning fuel. At each stoking this thin layer must be thoroughly stirred, as previously described, and some of the half-burnt fuel from the bank pushed forward to maintain the fire. New coal may then be added to the bank. The regulator of the ash pit door should be opened only sufficiently to maintain a clear fire, and it may be necessary to open the fire door very slightly during this period.

The essential tools required for the correct management of the furnace consist of a small pointed shovel, a properly-made furnace rake and a slice.

It is absolutely essential that ash should not be allowed to accumulate in the ash pit. If ashes are allowed to pile up close under the fire bars the bars will become overheated and distorted, and the efficiency of the furnace will be seriously impaired.

Considerable difficulty may be experienced in training natives to manage the furnaces on the lines indicated above. They usually prefer to fill the furnace with coal and then wait until the fire is nearly burnt out before refuelling. If the barn gets too hot they will open the furnace door, thereby wasting fuel. They will omit to remove the ash from the ash pit, with the result that the fire bars will be ruined in a very short time. It must be appreciated that if these methods of stoking are permitted, temperature fluctuations will be such that good curing is impossible, and the consumption of coal will be excessive.

The more detailed instructions drawn up by Captain Lowe, of the Tobacco Research Board, for the Management of the T.R.B furnace, referred to in Section 9, might, with advantage, be applied to the ordinary coal-burning furnace.

If properly managed and used in conjunction with efficient flues in a 16 ft. x 16 ft barn, the consumption of the ordinary type of coal burning furnace may vary between 2,500 and 3,000 lbs. per curing.

9. THE T.R.B. COAL-BURNING FURNACE.

This furnace, to which Figures 7, 8 and 9 refer, has been designed by Eng Capt C F Lowe, C.B.E., of the Tobacco Research Board, to meet the need of an efficient and economical coal-burning furnace This furnace consists primarily of a fire box, or furnace proper, and a combustion chamber divided by a hollow baffle wall of special design. The side and rear walls are hollow, the cavities between the inner and outer walls being 3 ins wide. The cavities on either side of the fire box are employed to pre heat a supply of air which is admitted from the ash pit into the cavities, from which it is eventually released through ports in the top of the baffle wall to mingle with the burning gases from the fire as they pass over it The introduction of additional air at this point serves to ensure the complete combustion of the fuel gases before they enter the flues The cavities surrounding the combustion chamber are completely cut off from the other cavities, and serve to pre heat air drawn in through the rear of the furnace before it is released into the barn, through gaps left between the bricks which partially cover the top of the cavities. The path of the air passing through all the cavities is prolonged by sheet iron baffles

The fire grate is made up of 12 fire bars 32 ins. long spaced to occupy the full interior width of the furnaces. A water-tight ash can, made of cast iron, or fabricated from sheet steel, is placed below the fire bars. This should be kept nearly full of water to provide a supply of water vapour which helps to improve the combustion of the coal. The furnace is fitted with a cast-iron

fire box door, and an ash pit door. The latter must be furnished with an air regulator.

Ordinary burnt bricks will not withstand the high temperature produced in the upper portion of the furnace, and for this reason all brickwork in courses 7 to 13 inclusive, in the inner 4½ in. lining of the fire box and combustion chamber, and the whole of the baffle wall above the 6th course, must be built with fire bricks. The tie bricks marked "T" in the drawing should also be fire bricks. The arch forming the roof of the furnace must be built of special "end taper" fire bricks of the dimensions shown in the drawing (Figure 7). Hard, sound, well-shaped farm or other locally made stock bricks may be used for the remainder of the brickwork, provided they are of suitable dimensions. This is important, since in order to construct the walls correctly, each course of bricks in the outer wall must be kept at the same height as the corresponding course in the inner wall. The fire bricks, which measure 9 ins. x 4½ ins. x 3 ins., are very uniform in size and shape, which enables them to be laid with joints only ⅛ in. thick which effects economy in the use of the "Searest," a special brand of fire clay, in which it is recommended these bricks should be laid. It is difficult to lay ordinary bricks with such thin joints unless they are particularly well shaped, and it is therefore a great advantage if they are slightly smaller than the fire bricks, particularly in thickness, which should not be more than 2¾ ins. These ordinary bricks should be laid in dagga.

The use of two types of brick is only suggested on account of the relatively high cost of the fire bricks, which vary in price from about 6d. to 7½d. each, according to make. Otherwise it would be far more satisfactory to use them throughout.

The base of the furnace consists of a concrete slab at least 2 ins., but preferably 3 ins., thick, mixed in the proportion of 1 part cement, 3 parts clean, sharp sand and 5 parts stone. The ground on which the slab is laid must be thoroughly consolidated.

The dimensions of the slab and of the first course of brickwork are shown in Figure 7. It must be understood that in order to avoid the unnecessary cutting of the bricks and to enable the rather intricate bonding required in the walls to be easily maintained, it is important that the first course should be exactly equal to the length occupied by 12½ bricks when laid as stretchers. It is recommended that this number of bricks should be laid out on a level surface with gaps left between them equivalent to the thickness of the joints to be made. If, when measured, the overall length of these bricks differs by a few inches from that shown on the drawing, it will not matter.

Figure 8 shows in perspective the exact number and arrangements of the bricks required in each course, and if these diagrams are carefully followed, the resulting structure should correspond to the various general views shown in Figure 7. Each course should be commenced from the front end and continued to the first or second closer. Building should then be resumed from the rear end so that the closers, which are indicated by the letter "C," can be cut to the required length and laid last.

The doors, fire bar supports and baffle plates must be built in as the work proceeds. The "Tee" section fire bar supports rest on the 5th course, and their correct placing should be determined as follows:—

Place the furnace door frame temporarily in position. Place the front "Tee" bar across the inner walls so that the top of the "Tee" projects ½ in. under the flange of the door frame. Now place bricks "B" of the 6th course against the rear edge of the "Tee" bar. Next, lay rear "Tee" bar in position so that its rear edge is 32 ins. from the front edge of the front bar. Now lay one fire bar on each side of the furnace and set the rear "Tee" bar to give the fire bars a clearance of ⅛ in. to allow for their expansion. The front ends of the fire bars should just project by approximately ½ in. under the bottom flange of the furnace door frame, and should be between 1/16th in. and ⅛ in. below it. If necessary, the height of the door frame or the "Tee" bar must be adjusted to obtain this clearance. When the position of the "Tee" bars has been correctly adjusted, the bricks "B" and "R" are laid to hold them securely in position.

The horizontal and vertical baffle plates which are built into the side walls of the furnace and combustion chamber are required to prolong the passage of the air from the inlets to the outlets, and may be made from any suitable thin sheet iron which may be available, galvanised for preference.

In the original furnace the width of the ash can was 17½ ins., which fitted comfortably inside the brickwork, and had to be placed in position before the 3rd course of bricks was laid, but a narrower cast-iron tray has since been obtained which can be inserted through the opening in the ash pit door frame, so that it is replaceable at any time without disturbing the brickwork of the furnace.

When the 13th course has been completed, the arch must be laid as indicated and directed in the drawing (Figure 7).

Special "end taper" fire bricks of the dimensions shown are required for this purpose. It is important to note that the ends of the arch butt against the end walls, and must not rest on them, otherwise the arch will break its back. The headers which close the cavities (course 14) are laid hard up against the outer arch bricks. When the arch and the side walls have been completed, the rear wall above the 10th course, which was left unfinished to permit the arch former to be removed, may be completed. The whole furnace should be allowed to dry out for a period of not less than three days before a fire is lighted.

The top of the furnace provides a convenient support for a shallow sheet iron tray in which wet sacks may be placed to increase the humidity during the wilting or colouring period. The tray should be supported by bricks placed at intervals round the walls so that it does not rest on the arch.

This furnace is intended to be built entirely inside the barn in order to reduce heat losses to a minimum. The only objection which some growers may have to this arrangement is, that on the completion of one curing the residual heat contained in the brickwork may make it necessary to wait for a period of approximately

3 hours until the temperature of the barn has dropped sufficiently to allow it to be refilled. This objection may be overcome by building the furnace in such a way that the combustion chamber only projects into the barn. There is actually no reason why the whole furnace should not be built outside the barn, but in this case, the benefit derived from the arrangement by which air is warmed and circulated by the cavities round the combustion chamber would be lost. Any part of the furnace projecting from the barn should be protected from rain by a lean to roof or other effective cover.

The recommended construction of the outlet flues which may be followed, whether the furnace be built in conjunction with a new or existing barn, is shown in Figure 9, which also shows the procedure suggested when an existing barn is to be altered to accommodate this furnace, whether it is to be wholly or partially within the barn. The important point to be observed is that the wall of the barn over the furnace must be supported by a brick arch or reinforced concrete lintel. Also a small gap about ½ in. wide should be left on both sides between the furnace and the wall which can be sealed subsequently with dagga, preferably while the furnace is hot.

An alternative method of installing the furnace in the corner of an existing barn is also shown, but, as will be seen, it cannot be regarded as a very satisfactory layout, since the heat will be very unevenly distributed.

However, with the arrangement of flues shown, which should be followed closely, it may be regarded as a temporary expedient for an experimental trial of the furnace.

The Management of the T.R.B. Furnace. Detailed instructions for the stoking and management of the T.R.B. furnace have been drawn up by Capt. Lowe, and may be obtained on application to the Tobacco Division, Department of Agriculture.

Coal Consumption. From extensive trials it was determined that the furnace will cure a barn of tobacco with under a ton of coal, the cost per pound of dry leaf being from 0.6 to 0.75 of a penny. Household coal or cobbles can be burnt in the furnace with equally good results.

Materials Required. The materials required for the construction of this furnace are as follows:—

One cast-iron furnace door and frame.

One cast-iron ash pit door and frame.

The doors themselves are not shown in the drawing, but the dimensions of the opening are shown in Figure 7. The frames must be cast with flanges to project 4½ ins. into the brickwork.

Twelve fire bars 32 ins. long with ends 1½ ins. wide and webs designed to give air gaps ½ in. wide.

Two "Tee" section cast-iron fire bar supports 27 ins. long by 3 ins. deep by 2½ ins. wide.

One ash can of cast-iron or fabricated steel plate; length to be 2 ft. 8 ins. at top and 1 ft. 6 ins. at bottom; the rear

end to slope back about 4 ins. and front end to have more gradual slope of about 10 ins. to facilitate removal of ashes. The depth to be 6 ins. and the width such that it will just pass through the opening to the ash pit.

One galvanised sheet iron tray 36 ins. wide by 1 in. deep and about 6 ft. long to hold wet sacks.

250 fire bricks 9 in. x 4½ ins. x 3 ins.

90 "end taper" fire bricks 9 ins. x 4½ ins. x 3 ins. x 2½ ins.

200 lbs. "Searset."

700 hard, well-shaped burnt bricks.

2 pockets cement, for concrete base.

1 set of fire irons, consisting of slice, devil and rake.

10. THE "TOWNSEND" TOBACCO FURNACE.

This furnace shown in Figure 10, although designed primarily for use with the "Townsend" barn may be adapted for use with the more orthodox barn, by simply lowering the whole structure approximately 18 ins. to bring the inlet flue passage to a suitable height in relation to the floor of the barn.

The important feature of construction is in the hearth, about half the width of which slopes sharply down to one side at an angle which must be not less than 40 degrees from the vertical. A gap which should be exactly 1 in. wide is left between this sloping face of the hearth and the rail, or rails, which support the side wall of the furnace. As the ash forms, it falls away through this gap of its own accord. This gap also forms the air inlet to the furnace. It will be noted that four heading bricks are left loose to enable any deposit of clinker which may accumulate to be removed. One or more of these bricks may be withdrawn should more air be required, otherwise they should be kept sealed with dagga when the furnace is in operation.

All the brickwork below ground level should be laid in lime mortar, but the remainder should be laid in dagga. A well-fitting fire box door is essential. This may be fabricated from thin iron plate, but a cast-iron door and frame, as shown in Figure 6 a, is to be recommended as being more durable and satisfactory, but it may be pointed out that since the door is situated well away from the area of the fire, it is not subjected to any great heat.

In order to prevent the brickwork platform immediately behind the door from being broken or worn away by the logs being pushed into the furnace, it should be protected by a flat sheet of iron laid on it, and extending a few inches into the wall on either side. A piece of 1/16th plate or a sheet cut from the sides of an old drum will serve for this purpose.

The ash pit may be simply a hole excavated beside the furnace, but it is better to line it with brick walls projecting a few inches above the ground, particularly if there is any danger of storm water washing into the pit.

11. THE "GUNDRY" TOBACCO FURNACE.

Particulars of this furnace were first published about fourteen years ago, and it is well known to a large number of growers. The important features of the design are that no fire bars or ash pit door are required, and it is therefore relatively cheap to con-

struct. It is very economical in fuel consumption and enables the temperature to be easily controlled.

When operated in conjunction with efficient tubular iron flues, the normal consumption varies from $\frac{3}{4}$ to $1\frac{1}{4}$ cords of wood per curing according to the length of the curing period.

In the original articles on this furnace, drawings of two types were shown. In Type 1 the fuel was fed through an opening in the top of the furnace, whereas in Type 2 a door is provided in the front of the furnace. As this latter arrangement has been found generally more satisfactory, the drawing of this type only, with certain minor modifications, is reproduced herein (see Figure 6).

The furnace may be built at any convenient distance from the barn, but it is not as a rule necessary or advisable for this distance to exceed 2 ft. In the drawing a distance of 14 ins. is shown, but this may be varied if desired.

When a brick chimney is already in existence, the furnace should be built directly opposite to it. A brick flue or tunnel may be built to run through the base of the chimney and barn wall to connect the furnace with the flue within the barn, but great care must be taken to ensure that no leakage of air can take place between this brick flue and the flue shaft of the chimney. To prevent this, a piece of thin sheet iron may be placed horizontally in the brickwork separating the two, as indicated in Figure 2, but this is not absolutely necessary if a sound job is made of the brickwork. It is not advisable to carry the metal flue pipe direct into the back of the furnace, as was shown in the original drawing, since the metal soon burns through.

The excavation for the foundation should extend down to a compact formation and should not as a rule be less than 9 ins. deep. The foundation should preferably be laid in lime or cement mortar, as either of these materials is far more permanent than dagga. The top of the foundation which forms the hearth may be at any convenient height to suit the barn, but should be not less than 3 ins. above the level of the surrounding ground. As the level of most barn floors is between 3 ins. and 9 ins. above ground level, the arrangement shown in the drawing can be followed without difficulty. Under other conditions the brick flue can be built at any convenient level in the rear of the furnace to suit the barn without affecting its working.

When completed, the foundation should present a level platform of brickwork on which the walls are built. Specially hard bricks should be selected to finish the central section of the foundation which forms the hearth of the furnace. Ordinary good building dagga, not too rich in clay, should be used for building the remainder of the furnace. The first course of the walls should be carefully set out to the correct measurements with gaps left in each side to form the air inlets. The bricks immediately above these openings may be cut to form a "french" arch, or they may be supported by a small sheet, or strips of thin flat iron. In one side wall, in line with the bottom of the cavity behind the baffle wall, two heading bricks should be left loose so that any accumulation of ash can be removed from the cavity.

These bricks must be sealed in with dagga when the furnace is in operation, to prevent the admission of cold air into the flues.

It should be noted that the dimensions given for the furnace correspond roughly to multiples of standard brick sizes, and there is no need to cut them except to make the usual closers to obtain a proper bond. The stepped inclined hearth and the baffle wall should be built up with the side walls and be bonded to them at each alternate course.

The side walls, which are 9 ins. thick, should be built in colonial bond, i.e., three courses of stretchers and one course of headers alternately. When the fourth course has been laid, it is advisable to build in two strands of barbed wire or strips of hoop iron between each second course, as indicated in the drawing, up to the 12th course. These will not prevent the walls from cracking but will strengthen them generally. When the stepped hearth which forms the front wall of the furnace is ten courses high and 14 ins. thick at the top, the cast-iron fire door frame should be set in position and built in, together with the clamping bolts, as the work proceeds. The 15th, 16th and 17th courses of the side walls are corbelled inwards to form the roof. The overhanging headers on the inside of the 15th course must be cut to a length of 6½ ins. to form the first step of the corbelling. The remaining corbels can be built with whole bricks. If any difficulty is experienced in laying these overhanging courses, a strip of wood can be placed to support them as they are laid, but after a few minutes the dagga will have set sufficiently to make them self-supporting. When placing the upper courses of the roof, each brick should cover the joint between the bricks below it.

It is very advisable to protect these and any other type of furnace from the destructive effects of rain either by means of a permanent roof supported on poles or loose covers, which may be placed over them in wet weather.

In order to obtain the maximum efficiency from this type of furnace, it is essential that it should be fitted with a proper door so that the stoke hole can be kept closed at all times except when it is being charged. In the original drawing a thin sheet-iron door was shown, but there is no doubt that a cast-iron door hinged to a flanged frame, as shown in Figure 6 a, will prove far more satisfactory and durable.

If a flanged door frame is not used, a piece of flat iron about 2 ft. long, 14 ins. wide and 3/16th in. or ¼ in. thick should be laid on the brickwork forming the bottom of the stoke-hole opening. This is necessary to protect the brickwork from being broken away by the logs as they are pushed into the furnace. Such a plate might well be inserted even where a flanged frame is installed.

The functions of the baffle wall are to prevent ash and unburnt fuel from entering and obstructing the inlet flue, and also to help to promote the more complete combustion of the fuel gases before they enter the flue. It is sometimes suspected of being the cause of the furnace failing to "draw" as soon as the fire is lighted. This is not the case, as will be gathered from the explanation of the working of the flue system given in Section 6.

Operating the Furnace. When the furnace has been completed it should be allowed to dry out for a few days. It should then be given a trial to see that it is satisfactory. A small fire should be lighted and the air inlets left open until it is burning freely and the chimney is "drawing." The air inlets should then be partially closed with loose bricks so that a slow-burning fire is maintained for several hours to dry out the furnace. The fire may then be increased and the temperature gradually raised to the maximum required. It may be necessary to open the air inlets slightly more, but a surprisingly small amount of air is required to maintain a relatively large fire.

A deposit of completely burnt ash will gradually accumulate on the hearth, and this must be raked out through the vents as often as may prove necessary to prevent it from choking them and restricting the flow of air. A small rake made from a piece of hoop iron bent to a right angle is the most convenient tool with which to do this, but care should be taken not to remove an undue quantity of live charcoal, from which a considerable amount of heat may still be generated. If the flues are working efficiently, the barn should attain a temperature of from 160 degrees to 170 degrees F. in from one to one and a half hours with the furnace about half-full of fuel. If any difficulty is experienced in getting the furnace to draw, or if results comparable with those mentioned above are not obtained, an explanation will probably be found in Section 6, which deals with the general principles on which all such furnaces and flues operate.

One or more horizontal cracks usually appear in the side walls of the furnace. These occur in the outer course of brickwork only and are due to the unequal expansion of the inner and outer layers of bricks. They will not, therefore, interfere with the functioning of the furnace, and can easily be filled with dagga.

The materials required to build this furnace are approximately 2,000 bricks, half a bag of lime for laying the foundation, a fire door similar to that shown in Figure 6 a, and about 75 feet of barbed wire or hoop-iron.

12. FLUES.

The flues are the radiators by which some of the heat contained in the flue gases is transferred to the air within the barn, and, as previously explained, they form the essential passage by which air is drawn into the furnace by the draught in the chimney. For reasons of convenience and cheapness, they are usually made circular in sections, and of a simple shape which gives a reasonable degree of efficiency, but if it were not for the additional cost involved, there is little doubt that their efficiency could be considerably increased by various means. They might, for instance, be made of square or thin rectangular or oval section. Or again, they might be fitted with internal baffle plates and external radiating fins, and so on—all with the object of enabling, within certain necessary limits, more heat from the flue gases to be usefully employed. It is reasonable to anticipate that in the near future some inexpensive means of increasing their efficiency will be devised, but in the meantime the ordinary conventional type will be referred to here.

These are, as a rule, made from 22 G. black sheet iron and have a diameter of approximately 11 ins., which allows them to be rolled from a standard size sheet of iron without waste. The rivetted and slip joints between the sections should be close-fitting, for the reasons explained in Section 6. When installed, they should be raised well above the floor to allow air to circulate freely round them. A convenient arrangement is to set the inlet 6 ins. above the floor and carry the flues on a slight upward incline, of approximately 3 ins. in the width of the barn, towards the outlet, as indicated in Figures 2 and 6 b. The outer limbs of the flues should be placed approximately 12 ins. from the four walls. This enables the maximum length of approximately 64 ft. of flue to be conveniently fitted into a 16 ft. x 16 ft. barn, or 72 feet into a 16. ft. x 20 ft. barn. It must be appreciated that if the length of flue is reduced much below these figures, the radiating surface will be reduced proportionately, and an increased rate of fuel consumption will be necessary to maintain the barn at any given temperature.

There are two well recognised methods of arranging the flues. One is to divide the inlet flue just inside the barn by means of a tee piece or brick junction box, as shown in Figure 6 b, and the second is to carry the inlet flue straight across to the far side of the barn where it is divided, as indicated in the drawing of the "Townsend" barn (Figure 11). Opinions are divided as to which is the best arrangement, some experienced growers preferring one and some the other, and in practice there is probably little to choose between them. There is, however, one point common to both arrangements which must be mentioned. It is sometimes observed that one branch of the flues becomes considerably hotter than the other. This is usually due to the fact that this branch is set higher or at a somewhat steeper upward slope than the other, and in consequence a greater volume of flue gases flows through it. The remedy is to adjust the height of the two branches until they maintain an even temperature.

New flues are, or should, be supplied with the adjoining section marked with letters or numbers to facilitate their re-assembly in the barn, and care should be taken to see that they are assembled strictly in accordance with such marking. When the flues are dismantled for cleaning or other purpose, they should be similarly marked to ensure that they are correctly re-assembled.

All flues should be cleaned and overhauled regularly at the end of each curing season so that they are ready for use the following year. It is a good idea to light a fire and test out the equipment in each barn well before the curing season is due to start, so that any deficiencies can be made good. Quite a lot of early tobacco is probably spoilt every year by growers who omit to take this simple precaution. When new sections of flues are required, it is very advisable to hand the adjoining sections to the maker so that the new parts can be made to fit properly.

"Searset," a special brand of fire clay, should be used for filling in loose joints or for sealing metal flue pipes into the chimney or brick junction boxes, as it is far more reliable than dagga.

13. GRADING AND BULKING SHEDS.

The type of building suitable for use either as a grading shed or bulking shed is shown in Figure 13.

The internal width has been restricted to 20 feet in order to keep the height of the front wall and the dimensions of the roof within convenient limits. For the bulking shed, a floor area of 70 ft. x 20 ft. should suffice for each unit of 50 acres of tobacco crop, and for a grading shed an initial allowance of 70 ft. x 20 ft. should be sufficient for the first 50 acres, while a shed of twice this area would probably represent the maximum size required for 100 acres or more.

The roof trusses are spaced 7 ft. apart, and in the grading shed the windows are similarly spaced and come mid-way between them, so that any obstruction of the light by the trusses is avoided. It must be noted, however, that for this spacing of the trusses the purlins must be of 3 in. x 3 in. timber, the cost of which, as compared with that of the usual 3 in. x 2 in. purlins, is more than off-set by the smaller number of trusses required.

If the length of the building is to be increased beyond 70 ft., it is suggested that the additional length should be made a multiple of 14 ft., so that the same convenient spacing of trusses, windows and buttresses may be maintained. If the roof is to be supported by rafters only, as indicated in the alternative section A.A., their spacing can be independent of that of the windows. It would not be advisable to increase the length of the building appreciably beyond 70 ft. without providing some additional support for the walls, either in the form of a cross wall with a communicating arch, or door, or one or more substantial buttresses projecting at least 4 ft. from the wall, either on the inside or outside of the building, in such a position that the greatest length of unsupported wall is from 50 to 70 feet.

A rafter roof is somewhat cheaper than a truss roof, but unless the rafters are made unduly heavy, they must be supported by a beam resting on pillars in the centre of the building. Incidentally, this central beam or bearer, if of imported sawn timber, should be 9 in x 3 in. and not 6 in. by 3 in. as indicated in the drawing. While such pillars may be somewhat inconvenient in a grading shed, there can be little objection to them in a bulking shed.

The exact size and type of window used in the grading shed is unimportant, provided that they are of sufficient area and are arranged to give an ample amount and uniform distribution of light.

The floors may be of cement-plastered bricks, concrete or of asphalt. The first-mentioned is generally the most popular, but asphalt floors made of the correct mixture of sand, fine gravel and bitumen have proved very satisfactory. Detailed instructions for laying such floors are usually available from the suppliers of the bitumen. The level of the floor should be at least 6 ins. above that of the surrounding ground.

Schedule of Quantities. The quantities of materials required to build a Grading or Bulking Shed 70 ft. x 20 ft. in accordance with Figure 13 are as follows:—

Item.	*Quantity.*
Bricks—Note 1.	
For Foundations	8,000
For Walls	28,200
For Floors	4,700
Lime—	
For laying Foundations	10 bags
For laying Walls	29 bags
Cement—	
For plastering Floor	24 pockets
For Damp Course Screed, Lintels, etc.	10 pockets
Damp Course Felt, 3 ft. wide	85 feet
Damp Course (Alternative), 26 G.Gal. Iron Sheets, 6 ft. x 3 ft.	15 sheets
Reinforcing Bars for Lintels, ⅜ in. dia. x 6 ft. long over Hooks	5
Eaves Gutter	74 feet
Eaves Gutter: Stop Ends	2
Down Pipes, 3½ in. diameter, lengths of 10 ft.	4
Down Pipes: Shoes	4
Corrugated Iron or Aluminium—Note 2.	
9 ft. sheets	41 sheets
8 ft. sheets	82 sheets
Corrugated Asbestos (Alternative)—	
9 ft. sheets	23 sheets
8 ft. sheets	46 sheets
Roofing Screws or Nails—	
For Iron or Aluminium	4½ gross
For Asbestos	2½ gross
Hoop Iron, 1 in. x 16 G. Gal.	140 feet

Timber	Section Inches	Length Feet	Number
Roof plates	$4\frac{1}{2}$ x $1\frac{1}{2}$	14	10
Roof plates	$4\frac{1}{2}$ x 3	14	5
Tie beams	6 x $1\frac{1}{2}$	22	11
Rafters	$4\frac{1}{2}$ x $1\frac{1}{2}$	24	11
Rafters (Alternative)	$4\frac{1}{2}$ x $1\frac{1}{2}$	10	11
	$4\frac{1}{2}$ x $1\frac{1}{2}$	15	11
Posts	$4\frac{1}{2}$ x $1\frac{1}{2}$	13	11
Struts	$4\frac{1}{2}$ x $1\frac{1}{2}$	15	11
Purlins (end)	3 x 3	16	14
Purlins (other)	3 x 3	14	21
Fascia Boards	9 x 1	16	2
Fascia Boards	9 x 1	14	3
Fascia Boards	6 x 1	16	2
Fascia Boards	6 x 1	14	3
Double batten doors, 2 ft. 3in. x 7 ft., with 3 battens and 2 braces			2 pairs
Frames for above doors of $4\frac{1}{2}$ in. x 3 in., rebated and grooved for mortar, 4 ft. 6 in. x 7 ft.			2
Windows for grading shed (see drawing)			9
Windows for bulking shed			2
Nails, screws and fittings as required.			

Notes.—

(1) The quantities of bricks shown are nett and no allowance has been made for wastage.

(2) If preferred, the roof may be spanned by two roofing sheets 12 ft. long. In this case 82 12-ft. sheets of corrugated iron or aluminium, or 46 12-ft. sheets of corrugated asbestos will be required, and the number of purlins may be reduced from 7 to 5 lines, 10 pieces 16 ft. long and 15 pieces 14 ft. long will be required.

14. NOTES ON BUILDING CONSTRUCTION, ETC.

The following brief notes on the more important items of building construction, as applied to tobacco buildings generally, are included for the guidance of those with little previous experience of building.

Selection of Building Site. When opening up a new tobacco farm, the selection of the site for the barns and other buildings should receive very careful consideration. Its situation in relation to the lands to be planted, not only in the first year or two, but in the more distant future, and its proximity to a permanent water supply, are probably the most important considerations. Other factors, such as its accessibility from a main road and from the site of the farm residence, should also be taken into account.

The desirability of a well-planned lay-out in which the lengths of necessary roads are kept to a minimum is obvious, since the maintenance of farm roads in serviceable condition, particularly when they traverse swampy ground, may prove a constant expense, and moreover, transport costs, which are no small item on a tobacco farm, are roughly proportional to the mileage covered.

The site selected should be as flat as possible, with a natural fall of 1 in 50 or 60, to ensure adequate surface drainage. The area selected should be sufficiently extensive to allow the full complement of buildings to be erected in proper relation to each other. The sub-soil, at a depth of about 18 ins., should be of uniform hardness throughout. Compact sand or small gravel are excellent formations on which to build, whereas clay soil is treacherous, due to its tendency to expand and contract with variations of moisture content.

A building erected on a site over which there is an appreciable variation in the hardness or composition of the sub-soil is liable to settle unevenly and develop cracks.

ESTIMATING QUANTITIES OF MATERIALS.

Bricks. To ascertain the number of bricks required for a building, first obtain the superficial area, in square feet, of all the walls, or parts of walls, which are to be of the same thickness, by multiplying the length of each by the height, and adding them together. Then multiply this total area by the number of bricks contained in each square foot of the walls according to their thickness. These are as follows: 5 bricks in a wall 4½ ins. thick, 10 in a wall 9 ins. thick, 15 in a wall 14 ins. thick, and so on.

The foundations may be dealt with in the same way, or, if preferred, the number of half bricks required to build up a complete cross-section of the proposed foundation may be counted, and the number multiplied by $\frac{4}{3}$ The result will be the total number of bricks required in each foot run of the foundations, and, when multiplied by their total length, will give the number of bricks required.

The number of bricks required to lay a floor may be taken as approximately 30 per square yard when laid flat, or 45 if laid on edge. The exact number will depend on the width of the joints between them.

Lime Mortar. One bag of lime (180 lbs.) mixed with 24 cubic feet of sand should be sufficient to lay 1,000 bricks, but for laying foundations a stronger mixture made with 1¼ bags of lime is to be recommended. If cement is to be mixed with the ordinary lime mortar, as referred to later, two pockets of cement should be allowed for every 1,000 bricks.

Cement Mortar. For a 1-6 mixture of cement mortar for laying 1,000 bricks, 4 pockets of cement and 24 cubic feet of sharp sand would be required.

The exact amount of mortar required for bricklaying is directly proportional to the thickness of the joints. The above figures are based on an average thickness of ½ in., which should not be exceeded by a competent bricklayer, unless the bricks are very irregular in shape or size.

Cement Plaster. For plastering floors or walls, a 1-3 mixture consisting of one pocket of cement (94 lbs.) mixed with 3 cubic feet of sharp sand will cover 35 sq. ft. 1 in. thick, 47 sq. ft. ¾ in. thick, or 70 sq. ft. ½ in. thick.

A 1-4 mixture consisting of 1 pocket of cement and 4 cubic feet of sand will cover 46 sq. ft. 1 in. thick, 68 sq. ft. ¾ in. thick, or 92 sq. ft. ½ in. thick.

Concrete. For making 1 cubic yard of concrete, the following quantities of materials will be required:—

Mixture	Cement (pockets of 94 lbs.)	Sharp Sand (cu. yds.)	Broken Stone (cu. yds.
1—2—4	5¾	.41	.89
1—3—6	4	.42	.92
1—4—8	3	.43	.94

Roofing Sheets. To determine the number of sheets of roofing material required, divide the total length of the roof in *inches* by the coverage of the sheets to be used. A sheet of corrugated iron or aluminium is 26½ ins. wide, and, with the usual side-lap of 1½ corrugations, covers 22 ins. Corrugated asbestos sheets are 41¼ ins. wide, and when laid with a side-lap of 2 ins., i.e., half a corrugation, will cover 39½ ins., or, if laid with a side-lap of 7 ins., i.e., 1½ corrugations, will cover 34¼ ins. The number and length of sheets required to reach from the top to the bottom of the roof can easily be determined. For a roof with a pitch of 20 degrees or more, an end-lap of 6 ins. should be allowed, but for a flatter pitch, an end-lap of 9 ins. to 12 ins. is recommended.

Preparing Lime Mortar. A clean, fairly coarse pit or veld sand should be used for making lime mortar. Very fine sands or sands containing a large percentage of silt or clay are unsuitable.

The required quantity of building lime should be spread in a layer about 12 ins. thick on a smooth, level platform of timber or sheet iron, or on a floor made of bricks grouted over with 1—6

cement mixture. The lime should then be surrounded with a ring of sand. As much water as it will absorb should then be poured on the lime, which will gradually disintegrate with the evolution of a considerable amount of heat. More water should be added later, if required, to reduce it to a thick cream. It should be left to slake for at least seven days, after which it may be thoroughly mixed with the sand in the required proportion while sufficient water is added to reduce the whole to a stiff plastic mass. This should be left in a conical heap, which must be kept moist, for a further two weeks. It is then ready for use, and may be re-mixed with water in small batches as required by the bricklayer.

For foundations, a small quantity of cement, approximately 10 per cent., may be added and mixed with each small batch of lime mortar immediately before it is used. This gives a very much harder and more durable mortar, but unless the batch is used within one hour of being mixed, the beneficial effect of the cement will be lost.

Mixing Concrete and Cement Mortar. Only clean, sharp river sand free from clay or silt should be used with cement for the making of concrete, mortar or plaster. All such cement mixtures should be prepared on a suitable mixing board or platform, and not on the bare ground. When making concrete, the exact quantities of cement and sand required should be accurately measured by tins or boxes, and thoroughly mixed while dry. The aggregate, which must be hard, clean stone broken to the required size, must also be accurately measured, and may then be added to the sand and cement. When mixing, the ingredients should be turned over several times by being worked from one end of the platform to the other and back again. When they are thus thoroughly mixed, the heap should be spread in a thin layer over the platform and the water added gradually with a watering can fitted with a rose while the mixing proceeds. A common error is to add too much water just before the concrete appears to be ready, with the result that with the final mixing it becomes too wet. Wet, sloppy concrete will be comparatively weak when it sets, and in order to obtain the maximum strength and hardness, it should be mixed with only just sufficient water to make it workable. All concrete must be placed in position and left undisturbed within a maximum period of 45 minutes from the time water is first added to the mixture. All exposed surfaces of freshly placed concrete or cement plaster, such as floors, etc., must be covered with clean sand, grass or old sacks and kept damp for five days or longer, if possible. If a cement-plastered floor is allowed to dry out immediately, it will soon wear and crumble.

When mixing cement and sand only, for mortar or plaster, the same general procedure should be followed as that described in the preparation of concrete.

Clearing and Levelling the Site. The site of the building should be cleared of all loose material and vegetation to a depth of 4 ins. to 6 ins., and such clearing should extend from 6 ft. to 10 ft. beyond the area which will be covered by the actual building. The whole area should then be roughly levelled if necessary.

Setting Out the Building. The building should be set out accurately to the correct dimensions by means of wooden frames or pegs set at least 8 ft. from the corners of the building. The exact internal dimensions of the outside walls should be carefully measured off first, and aligned with pegs from which the position of the lines for the sides of the foundation trenches may be measured. Particular care should be taken to ensure that the width or span of the building is not greater than that for which the roof timber and sheeting has been planned or ordered.

The corners must be square, and may be set out by means of a light wooden triangle, the length of the sides of which must be in the exact ratio of 3:4:5, or, say, 3 ft., 4 ft. and 5 ft. As a final check, the diagonals of the rectangle should be measured, and if these differ by more than, say, 2 ins., the source of the error should be found and corrected.

Foundations. When the foundations are to be of brick or masonry, the width of the trenches should be 8 ins. or 12 ins. wider than the bottom course of the foundation, to allow comfortable working space for the builder.

If the foundations are to be of concrete, the lower parts of the trenches should be trimmed accurately with vertical sides to the exact width which the concrete is to be. The trenches must be carried down until a compact and uniform bottom is encountered. Even though a good bottom may be found at a depth of 9 ins. or 12 ins., the trenches should be not less than 18 ins. deep when measured from the cleared ground level. The bottoms of all trenches must be level, and if, owing to the slope of the ground or irregularities in the density of the sub-soil, it is found necessary to vary the depth, the variation should be made in definite steps of 3 ins. (the thickness of a brick). When the bottom has been trimmed to a flat, level surface, it should be tamped all over with a light, flat-faced rammer to further compact the surface. This operation will reveal any soft patches which may not have been apparent to the eye.

Only hard, well-burnt brick should be selected for building foundations. These may be laid in 1--6 cement mortar or lime mortar mixed in the proportion of 1¼ bags of lime to 1 cubic yard of sand. In either case, the bricks should be soaked in water for a few minutes before they are laid, as this enables the mortar to set very much harder than it would otherwise. Moreover, it enables the bricklayer to make rather thinner joints with greater ease, with a corresponding saving in mortar. The dimensions recommended for the foundations of the various buildings are indicated in the drawings. The corners, which should be built up first, must be accurately set out to the required dimensions, and the height at each second course should be checked at all corners to ensure that the foundations will be level throughout when completed. Before the damp course is laid, the floors should be built up to the required level by filling them in with soil, which should be placed in layers about 3 ins. thick, each layer being thoroughly compacted by judicious ramming before the next is laid. Particular care should be exercised to thoroughly compact the soil when refilling the foundation trenches on the insides of the building, otherwise it may subside and the floor will crack.

The Damp Course. A properly laid damp and ant-proof course of 26 G. galvanised iron or felt specially made for the purpose should be included in all buildings. A screed of 1—4 cement mortar on which the damp course should be laid is not, by itself, sufficient, since it is only partially effective in excluding dampness from the walls, and will sooner or later admit white ants through cracks in the screed itself or between the screed and the floor. The damp course should be at least 6 ins. above the surrounding ground level, and should project ½ in. on the outside of the wall and from 2 ins. to 3 ins. on the inside, so that it can be embedded in the concrete or cement plaster of the floor. If galvanised iron is used, each length should overlap its neighbour by at least 3 ins., and the end of each piece should be soldered to the surface of the piece below. Lime mortar will eventually destroy the galvanising, and cause the iron itself to rust through; it is therefore necessary to lay the first course of bricks above the foundations in 1—6 cement mortar, even if dagga is used to lay the remainder of the bricks.

Walls. The walls should for preference be laid in lime mortar mixed in the proportions of 1 bag of lime to 1 cubic yard of sand. Alternatively, they may be built in dagga. If dagga is used, all the face joints should be raked out to a depth of at least ¾ in., and later pointed with lime or cement mortar, either of which is more water-proof than dagga, and will serve to preserve the structure of the walls. All door frames and windows must be placed in position and be built in as the bricklaying proceeds. When the walls have reached the top of the door or window frames, arrangements should be made for casting the concrete lintels. These should project at least 9 ins. on each side of the opening, and should be made the full thickness of the wall. For a span not exceeding 3 ft. 6 ins., they should be at least 2 courses, or approximately 7 ins. deep. For wider spans up to 6 ft., they should be 3 courses deep.

The concrete for the lintels should be mixed in the proportion of 1 cement, 2 sharp sand and 4 stone aggregate, crushed to pass through a ¾ in. diameter hole. The lintels should be reinforced with round iron bars in accordance with the following table:—

One rod to each 4½ ins. in thickness of lintel over:

Openings up to 3 ft. span with ⅜ in. diameter bars.

Openings 3 ft. to 4 ft. span, ½ in. diameter bars.

Openings 4 ft. to 6 ft. span, ⅝ in. diameter bars.

The bars should be bent to form a hook at each end, the inside radius of the hook being about twice the diameter of the bar. The length of the bars, measured over the hooks, should be 3 ins. less than the lintel. They should be placed 1 in. from the bottom face of the lintel, and 4½ ins. apart. The timber shuttering for the lintels must be strongly constructed and well braced and supported to withstand the weight of the concrete, which must be worked into close contact with the reinforcing bars, and tamped in layer by layer. The side forms may be carefully removed 3 days after the concrete has been placed, but the supports below the lintel should not be disturbed for at least 10 days.

Brick Arches. Brick arches may be built over doors and windows in place of concrete lintels, with little difficulty. A centering, which is simply a wooden frame with a curved top by which the arch bricks are supported while being laid and until the mortar has set, is required for each particular width of opening. The curve of the arch should be such that the depth at the centre is not less than 1/12th of the span, i.e., an arch over an opening 4 ft. wide should be 4 ins. high at the centre. The arch for a span of 4 ft. or less should consist of two rings of bricks laid on edge. For greater spans up to 6 ft. three rings would be advisable. All the bricks must be hard and well burnt, and should be laid in 1—4 cement mortar.

If an arch is to be built near the outside corner of a building, it should be supported by one or more turning bars consisting of pieces of flat iron 3 ins. or 4 ins. wide by ⅜ in. thick bent to the curve of the arch, and projecting horizontally into the brickwork for a distance of 4 ins. on each side.

When the walls are within 3 ft. of the roof plate level, the anchors by which the roof is secured to the walls must be built in. The anchors should be made of black, or, preferably, galvanised hoop iron 1 in. or 1¼ ins. wide by 16 S.W.G. Each anchor should be 4 ft. 9 ins. long and bent to a right angle 3 ins. from the end by which it is secured in the brickwork. The anchors should be spaced so that they come immediately below each of the roof rafters, to which they must be securely nailed. Two strands of No. 8 S.W.G. galvanised wire may be used in place of hoop iron.

Floors. For heavy traffic, a concrete floor is very much more durable than one made of bricks and cement plaster, but if properly laid, the latter should prove quite satisfactory for tobacco buildings. The bricks should be laid flat on a bed of dry sand about 1 in. thick which is spread on the soil as the work proceeds. The level of each brick can be adjusted by varying the amount of sand below it. Each brick must be firmly bedded down by tapping it with a piece of timber, and a small space of about ¼ in. should be left between all the bricks to allow the grout to penetrate. When the bricks have been laid, they should be thoroughly soaked with water before the grout is applied. The grout should consist of 1 part cement and 6 parts of sand mixed to a sloppy consistency. It is spread on the wet bricks and brushed back and forth until the joints are all full, or very nearly so. The cement topping or plaster may be mixed in the proportion of either 1—3 or 1—4. The former will give a harder and more durable floor, but the latter, if properly laid and cured, should prove satisfactory for most purposes.

It is advisable to lay the plaster at least ¾ in. thick. As it is placed, it should be worked to a level surface with a wooden float and may then be smoothed over with a steel float, but if it is worked too much with the steel float, the surface may subsequently develop numerous fine cracks. The plaster may be divided into rectangular panels about 4 ft. to 5 ft. square by "Vee"-shaped grooves, which tend to localise any cracks which may occur. The grouted bricks must be kept quite wet while the plaster is being laid, and, as previously stated, the finished surface *must* be kept damp for at least 5 days.

Acknowledgment. The writer wishes to convey his sincere thanks to all those who have kindly assisted him in the compilation of this article.

The appearance and productiveness of your farm can be improved by agricultural cleanliness.

GIVE IT THAT "NEW LOOK"

Cleanliness Aids Insect Control.

Southern Rhodesia Veterinary Report

NOVEMBER, 1947.

General. Good rains have continued throughout the Colony and the cattle are beginning to improve rapidly in condition.

Tick Life. With the rains tick life has become increasingly active, but on many farms there is not enough water to commence weekly dipping.

Diseases. African Coast Fever. Salisbury District: No cases have occurred on Highland farm, but the dipping interval has still to be kept at seven days owing to the condition of the cattle.

Melsetter and Chipinga Districts: No cases on any of the infected farms, seven day dipping and hand-dressing is being carried out.

Anthrax. No outbreaks recorded.

Trypanosomiasis. Four cases were diagnosed in Chikwizo Reserve, Mtoko district, on the Portuguese Border. These were found in four kraals after smears had been taken of about 20 per cent. of the cattle in the Reserve and adjoining Crown lands.

Lumpy Skin Disease. A few mild cases reported from Gwelo and Bulawayo.

Quarter Evil. Only one outbreak was diagnosed.

Stiff Sickness. Has been reported from Bulawayo district.

Epi-Vagnitis. Three bulls were destroyed in Salisbury district.

Foot and Mouth Disease. Chipinga District: On the 4th November spread of disease on the east bank of the Sabi River was found at Chikore Mission farm through cattle that were dipping at the Mission having had previous contact with cattle dipping at Chibuwe; Chikore Annex and Craigmore were infected on the 14th November and Hermit on the 22nd and Nyatutu on the 24th.

Owing to lack of fencing and contacts due to dipping and lack of control of cattle in general, it was found necessary to include the following farms and native areas in the cordon, which have all been inoculated:—

On 20th November Mwumbe, Emerald, Greymuir.

21st Elizabethville, Sannies Rust, Smalldeel, Chikore and Annex Chikore.

2nd Wakkerstroom, Bamboo Creek, Sable Home, Hermit, Hogwe, Umzilizwe, Umsasa.

24th Nyatutu and Gwenzi.

Mortality in calves inoculated on Sable Home and Umzelezwe was high. This, in my opinion, was due, not to inoculation, but to malnutrition and lack of proper care and attention.

Fort Victoria: There has been no extension in this district except on Devuli Ranch, where, as predicted in my last report, the internal cordon failed to cope with the straying of cattle and infection was found at Danani Borehole. The cordon was moved to include the infected herds in an endeavour to prevent further spread.

Piroplasmosis. Cases have been reported in both Salisbury and Bulawayo. On the farm Albany in Melsetter district cases are also occurring, and as this is a coast fever farm Redwater infection should have been dipped out at least eighteen months ago. When Redwater appeared on the farm, in case of the possibility of arsenic resistant Blue Ticks, the owner was advised to use a Gammexane dip in conjunction with arsenic in his tank, and he has been doing this now for the past six months; but occasional deaths are still continuing, giving an indication that Gammexane is little if any more effective than arsenic.

Mallein Test. Forty-one horses and a hundred and ninety-seven donkeys were tested with negative results.

Tuberculin Testing. Thirty-three bulls, one cow, five heifers and three yearlings were tested with negative results.

IMPORTATIONS.

United Kingdom: 2 sheep (breeding), 1 bull (breeding), 2 pigs (breeding), 4 cows and calves.

Bechuanaland Protectorate: 50 sheep (slaughter).

Union of South Africa: 5 sheep (breeding), 100 sheep (slaughter), 41 bulls (breeding), 18 geldings, 24 horses and mares, 6 cows and calves.

EXPORTATIONS.

Union of South Africa: 147 donkeys, 2 horses and mares.

Northern Rhodesia: 3 pigs (breeding).

Belgian Congo: 44 pigs (breeding).

Portuguese East Africa: 40 oxen (slaughter).

EXPORTATIONS—MISCELLANEOUS.

In Cold Storage.

Union of South Africa: Veal 4,038 lbs., pork 6,058 lbs., sausage casings 4,577 lbs.

Bechuanaland Protectorate: Beef 893 lbs., bacon 278 lbs., sausage 301 lbs., fats 158 lbs., offal 73 lbs., pork 201 lbs., brawn 5 lbs.

Northern Rhodesia: Bacon 17,386 lbs., fats 5,700 lbs., offal 3,206 lbs.

United Kingdom: Bacon 5,953 lbs.

Meat Products from Liebeg's (Rhodesia) Ltd., West Nicholson.

Union of South Africa: Vienna sausages 11,250 lbs., bobotie 347 lbs.

Belgian Congo: Corned beef 10,800 lbs., Vienna sausages 1,125 lbs., jellied beef 79 lbs.

P. D. HUSTON,
Chief Veterinary Surgeon.

Price List of Forest-tree Transplants, Ornamental Trees and Shrubs, Hedge Plants, Creepers and Seeds.

OBTAINABLE AT THE GOVERNMENT FOREST NURSERY, SALISBURY.

AS AT 1st MARCH, 1948.

1. Transplants of forest trees, etc., are obtainable at the subjoined rates and subject to stocks and containers being available.

2. Orders should be addressed to the Conservator of Forests, Salisbury; or Manager, Forest Nursery, P.O. Box 387, Salisbury.

3. **All orders must be accompanied by a remittance in cash, bank note, postal order, draft or cheque, made payable to the Department of Agriculture, Salisbury. Under no circumstances will plants or seeds be sent out or taken away from the Nurseries unless paid for. Stamps to the value of one shilling will be accepted.**

4. All transplants are despatched at Rate 10 on railways at purchaser's risk. The transplants are watered as far as this is possible by the railway staff.

5. All prices quoted are for delivery free at any railway station or siding in Southern Rhodesia. **Road motor service charges are payable by consignee and must be included in remittances, otherwise plants will be railed to nearest Station or Siding.**

6. Purchasers of trees contained in boxes of 50 trees are requested to return boxes, carriage forward, to the nursery from which they are obtained, or to the Manager, Forest Nursery, Salisbury. **If the boxes are not returned within two months from date of issue, they will be charged for at 1/- each respectively.**

7. **No plants, except forest trees, will be reserved. Orders will be executed in order of receipt as trees are ready for despatch. Every effort will be made to comply with instructions of purchasers.**

8. Transplants of forest trees, when quoted at per 1,000, are grown in boxes containing 50 transplants. The average weight of box is 50 lbs.

9. Shrubs and ornamental plants in single tins have a weight of about 5 lbs.

10. To purchasers of forest trees only, the following reductions are made :—

(a) When the number exceeds 1,000, the price is £3 5s. per 1,000.

(b) When the number exceeds 5,000, the price is £2 14s. per 1,000.

11. Orders for seed are posted or railed free of charge.

12. Though every care is taken to supply trees and seeds true to name and of good quality, no guarantee can be given in this respect, more particularly in regard to seed.

13. Intending tree planters are invited to apply to the Conservator of Forests, Division of Forestry, Salisbury, for advice as to the most suitable trees for growing in the various climates and soils of the Colony, and on the best methods to adopt in the formation of plantations, wind breaks and shelter belts.

14. **No responsibility taken after trees, shrubs, etc., have been accepted by the Railways. Any claim for loss or death should be made to the Railway Company.**

15. This list cancels all previous lists.

16. Hours of Business: Weekdays, 9 a.m. to 1 p.m. and 2 p.m. to 4.30 p.m. Saturdays, 9 to 11 a.m. Closed on Sundays and Public Holidays.

Price of Transplants.—For convenience, the following symbols are used to indicate the purchase prices of transplants :—

A—Trees, 50 in box, 4s. 6d. per box; £3 5s. per 1,000; £2 14s. per 1,000 for orders over 5,000.

E—Trees and shrubs at 9d. each unless otherwise stated.

Botanical Name.	Common Name.	Remarks.	Price of trans-plants.	Price of seed. Lb.	Oz.
Callitris calcarata ...	Black cypress pine ...	Usually rather slow growing, but reaches a fair size and produces a valuable durable softwood. Suited for dry country planting, especially in sandy soil. Good shelter for orchards, etc.	A.E.	15s.	1s.
Casuarina cunninghamiana	Beefwood	A fine large shade tree, suitable for avenues and narrow belts. Requires deep soil in drier localities. The foliage is useful for stock fodder, and the tree stands lopping well.	A.E.	...	2s. pkt. 1s.
Cedrela odorata		A rapid-growing tree similar to Cedrela toona, but with lighter foliage. Likely to do well on heavy soils, fairly free from frost. 30 to 40 feet in height.	E.	15s.	1s.
Cedrela toona	Toon tree	A rapid-growing, handsome, semi-deciduous tree, suited for moister localities where frost is slight. Yields a valuable soft timber. Recommended for shade and ornament.	A.E.	15s.	1s.
Cupressus arizonica ...	Arizona cypress	A hardy evergreen tree, suitable for dry localities, but requiring a well-drained and rather deep soil. Useful for shelter belts and also for hedges when closely planted.	A.E.	15s.	1s.
Cupressus lusitanica ...	Portuguese cypress ...	A fast-growing cypress, producing an excellent softwood timber, but requires a moist, cool climate and a good soil. May well be used for shelter and hedges in favourable localities.	A.E.	5s.	6d.
Cupressus sempervirens, var. horizontalis	Common spreading cypress	A hardy cypress, suited for limestone as well as other soils. Not so frost or drought hardy as Cupressus arizonica. Suitable for shelter and hedges.	A.E.	15s.	1s.
Cupressus sempervirens, var. pyramidalis	Common upright cypress	An ornamental tree for gardens and cemeteries. Also useful as a shelter tree. Grows under similar conditions to the "var, horizontalis."	A.E.	15s.	1s.

Cupressus torulosa ...	Himalayan cypress... ...	A good tree for timber, hedges and shelter. Withstands much cold and drought. Not very soil exacting, but will not stand waterlogging. Fairly frost-hardy. A very reliable tree.	A.E.	10s.	9d.
Eucalyptus botryoides	Bangalay	A large-leaved, heavy-foliaged gum. Quick growing. Suitable for granite and red soils. Withstands frosts, but not very drought-resistant.	A.	15s.	1s.
Eucalyptus citriodora ..	Lemon-scented gum ...	A clean-boled tree, producing an excellent timber. Leaves lemon-scented. Suited for wetter regions and on the better soils in the lower rainfall regions. Will not withstand much frost or drought. Flowers prolifically, rendering it very useful for honey production.	A	15s.	1s.
Eucalyptus crebra... ...	Narrow - leaved iron-bark	A slow-growing, deep-rooting species, producing excellent timber. Withstands drought and light frosts.	A.	15s.	1s.
Eucalyptus maculata ..	Spotted gum	One of the best trees for timber production or shelter in the wetter areas, being fairly hardy to drought but not to frost. Produces an excellent timber.	A	15s.	1s.
Eucalyptus maideni ...	Maiden's gum	A very fast-growing, large tree, with bluish foliage in youth. Fairly drought and frost resistant. Will grow on poor soils if deep and well-drained. Produces a good, strong, useful timber.	A.	30s.	2s
Eucalyptus melliodora	Yellow box...	A medium-sized tree, useful for shelter belts. Produces a tough, durable timber. Very resistant to drought and frost. Valuable for honey production, having abundant sweet flowers.	A.	15s.	1s.
Eucalyptus microcorys	Tallow-wood	A neat heavily foliaged tree suitable for high rainfall areas.	A.	15s.	1s.

Botanical Name.	Common Name.	Remarks.	Price of trans-plants.	Price of seed. Lb.	Oz.
Eucalyptus paniculata	Grey ironbark	A very good timber tree, with heavy foliage. Suitable for the moister regions, with a deep, fertile soil. Withstands some drought, but is frost-tender. Yields an excellent, hard, durable wood.	A.	15s.	1s.
Eucalyptus punctata ...	Leather jacket . . .	A tree of fair size, yielding a good, durable timber. Adaptable as regards soil and climate, but will not withstand a dry cold climate.	A.	15s	1s.
Eucalyptus rostrata ..	Red gum	Produces an excellent and durable hardwood. Withstands drought, heat, brak, flooding and a good deal of frost. One of the best species for planting in Southern Rhodesia, except in sour soil and wet mountain regions.	A.	15s.	1s.
Eucalyptus saligna... ...	Sydney blue gum	A fast-growing, useful tree, producing a useful medium hardwood. Thrives on deep, fertile soils in the heavier rainfall areas. Tender to frost and drought.	A.	15s.	1s.
Eucalyptus tereticornis	Forest red gum	Similar to Eucalyptus rostrata, and can be planted along with it, except in areas liable to flooding and great heat. Perhaps not quite as drought-resistant.	A.	15s.	1s.
Grevillea robusta	Silky oak	A handsome tree which thrives best in moist, warm localities. Useful for ornament, shade and timber. Frost-tender and not resistant to drought. If the locality is unsuitable, it may grow well for several years and then die out.	A.E.	...	pkt. 1s

Jacaranda mimosaefolia	Jacaranda	An ornamental deciduous tree with feathery foliage and abundant blue flowers, which appear in spring. Best development is attained in the moister regions, but the tree withstands drought to a surprising extent, and may be planted in the drier regions if the soil is reasonably deep and fertile. It is tender to cold and frost, and may need protection in its earlier youth.	A.E.	20s.	1s. 3d. pkt. 1s.
Pinus canariensis	Canary Island Pine ...	Hardy to drought, but not to severe frost. Best suited for planting on higher altitudes and in higher rainfall areas. Slow growth in early youth, then more rapid in later years. A handsome tree with inverted, umbrella-like branches, not spreading. Yields an excellent softwood timber.	A.E.	15s.	1s.
Pinus halepensis	Aleppo pine	A drought-resistant pine which will grow on limestone and shale soils. Not recommended for plantations, but can be used for shelter and ornamental purposes in the drier regions.	A.E.	15s.	1s.
Pinus patula...	Patula pine	A fast growing pine with graceful drooping needles. Does best in higher rainfall areas. Produces a useful softwood.	A.E.	15s.	1s.
Pinus radiata (insignis)	Remarkable pine	A large tree of very rapid growth, producing a useful softwood. Most at home in the heavier rainfall areas. Does not like sour or poorly-drained soils. Frost-hardy but not drought-resistant, usually failing at an early age in the drier regions. It should be planted with caution in areas under 30 inch rainfall. Recently this tree has been severely attacked by *Diplodia pinea* and it is advised that the Forest Department be consulted when new plantations are contemplated.	A.E.	15s.	1s.
Pinus longifolia	Chir pine	A somewhat slow-growing pine, but useful to plant in localities where the climate and soil are doubtful at the higher elevations. For timber and ornamental purposes. A useful tree in all respects.	A.E.	15s.	1s.

Botanical Name.	Common Name.	Remarks.	Price of trans-plants.	Price of seed. Lb.	Price of seed. Oz.
Populus alba	White poplar	A rapid-growing poplar, requiring a good, deep soil in close proximity to running water. Propagated by suckers. Deciduous.	Suckers at 9s. per 100		
Populus deltoides, var. missouriensis	Carolina poplar...	A very fast-growing poplar, producing a very good timber for matches. Requires a rich, moist, alluvial soil. Moderately frost-hardy. Does not like stagnant water.	E.		
Salix babylonica	Weeping willow	A useful timber and ornamental tree, requiring a moist, well-drained soil which is occasionally flooded. Not suited for ground in which water is stagnant.	4d. each.		
		Ornamental Trees, Shrubs and Hedge Plants.			
Abelia floribunda	—	A shrub with myrtle-like leaves, evergreen if watered. Pink-white flowers in profusion. Is used for hedges in Natal.	E.		
Acacia baileyana	Bailey's wattle	A small ornamental tree with blue foliage and yellow flowers.	E.		
Acrocarpus fraxinifolius	—	A small tree up to 40 feet in height; attractive foliage. Fast growing.	E.		
Agapanthus umbelatus	Cape Lily	Blue variety.	E.		
Alstonia scholaris... ...	—	A white flowered shrub, 6 feet high, similar to Oleander.	E.		
Bauhinia acuminata ...	Bauhinia	A small tree, flowering profusely in early spring. White flowers. Hardy.	E.	..	pkt 1s
Bauhinia galpini	Pride of de Kaap	A rambling shrub, bearing orange-red flowers. Hardy.	E.	...	pkt. 1s

Bauhinia purpurea ..	Bauhinia	Similar to the Bauhinia acuminata, but with mauve flowers. Hardy.	E	... pkt. 1s
Berberis darwinii	Berberis	Dwarf evergreen shrub with orange flowers and orange berries.	E.	
Bolusanthus speciosus	Rhodesian tree wistaria	An indigenous semi-deciduous tree with blue flowers at the end of long stalks. Ornamental.	E	
Buddleia sp.	Blue buddleia	A medium-sized shrub with sweet-scented blue flowers. Useful as a hedge. Rapid-growing, but frost-tender.	E	
Buddleia sp.	Yellow buddleia	A rank-growing, yellow flowering shrub. Rapid-growing. Frost-tender. Both Buddleias are very subject to leaf-eating beetles.	E	
Callistemon speciosus	Bottlebrush	A scarlet-flowering shrub of drooping habit. Makes an excellent hedge if trimmed along the top only.	A.E.	... 2s. pkt. 1s
Calodendron capense ...	Cape Chestnut	A fine ornamental tree up to 20 feet high with white flowers marked with pink. Sometimes takes up to 10 years before flowering.	E.	
Carica papaya	Pawpaw	A small tree with large, dark green foliage, bearing large edible fruits.	E	
Casimiroa edulis	Mexican apple	A large, rapid-growing tree, 30-40 feet in height, evergreen, and bears a delicious fruit. A fine shade tree if pruned to stake early.	E.	
Cassia sp.	Caruda	Evergreen tree up to 20 ft. high with masses of yellow flowers.	E.	
Cassia capensis	Cape laburnum	A rapid-growing shrub, bearing masses of bright yellow flowers.	E.	
Cestrum aurantiacum	Ink berry	A small shrub, bearing orange flowers in profusion.	E.	
Castanospermum australe	Australian chestnut	A very fine shade tree similar in growth to Cedrela but with shiny evergreen leaves and pretty flowers.		1s. 6d. & 2s. 6d. each.
Citharexylum sp.	—	A deciduous shrub up to 15 ft. in height. Grown for its lovely leaves, which become highly coloured in autumn.	E.	1s. 6d.
Croton sylvaticus	Mount Selinda linden	A large-leaved, deciduous tree from Melsetter.	E.	
Cryptomeria japonica	Japanese Cedar.	A quick growing coniferous tree only suitable for high rainfall areas.	E.	

Botanical Name.	Common Name.	Remarks.	Price of trans-plants.	Price of seed. Lb.	Price of seed. Oz.
Cryptostegia grandiflora	—	A decumbent creeper with shiny foliage and large mauve flowers. Not recommended as a climber.	E.		
Cyphomandra betacea	Tree tomato	The well-known tree tomato. Will grow anywhere where Paw Paws will thrive.	E.		
Datura arborea...	Tree potato	A large shrubby tree, up to 30 feet in height, with large purple flowers. Very quick grower. Fruit poisonous.	E.		
Deutzia crenata	Bridal wreath	A small deciduous shrub with double white flowers, tinged slightly pink, on long, drooping stalks.	E.		
Dodonea viscosa	—	Indigenous shrub. Makes a good hedge in Matabeleland but dies out after a few years in Mashonaland.	A.E.		
Duranta alba	White tree forget-me-not	Similar to Duranta plumieri but has white flowers.	E.		
Duranta plumieri	Tree forget-me-not.. ...	A medium-sized, deciduous shrub with blue flowers. Useful as a hedge. Very hardy.	E.		
Eranthemum sp.	—	A shrubby herbaceous plant covered with intense blue flowers in the autumn, likes shade, evergreen, 3 feet high.	E.		
Eugenia braziliensis ...	Brazilian cherry	A small shrub, bearing scarlet-coloured, edible fruits. A useful hedge plant.	E.		
Euphorbia splendens ...	Christ thorn...	A small thorny shrub with bright scarlet flowers. Suitable for low hedges and borders.	E.		
Ficus petersii	Wild Fig	Indigenous tree up to 40 ft. high. Evergreen and shady, but has large surface roots.	1s. 6d. each.		
Freylinia tropica	Inyanga hedge plant ...	A useful hedge shrub. Indigenous.	E.		
Gardenia florida	Katjepeering	A compact, evergreen shrub with dark green, glossy leaves and pure white, sweetly-scented double flowers.	E.		

Hamelia patens...	—	A compact shrub 8 feet to 10 feet in height, flower orange-yellow tubes, a showy shrub.	E.
Heliotropium peruvianum	Heliotrope	A small shrub with sweet-scented lilac or nearly white flowers. Suitable in flower border.	E.
Hibiscus rosa-sinensis	Chinese rose	Evergreen shrub with numerous scarlet flowers. Double and single varieties.	E.
Holmskioldia sanguinea	Holmskioldia	A fairly hardy shrub, bearing a profusion of brick-red flowers in large bunches. Suitable for hedges.	E.
Holmskioldia sp.	Holmskioldia	A yellow-flowering, handsome shrub similar to Holmskioldia sanguinea.	E
Holmskioldia sp.	Holmskioldia	Similar to the above but mauve bracts and blue flowers.	1s. 6d. each.
Hypericum lanceolatum	St. John's wort	A small, yellow-flowering shrub. Multitudes of flowers.	E.
Iochroma tubulosa ...	Iochroma	A shrub with dark blue flowers.	E.
Khaya nyasica	Banket Mahogany.	An evergreen timber tree, fairly fast growing on deep soils.	E.
Lagerstroemia eavesii	Mauve Pride of India	Similar to Lagerstroemia indica but has mauve flowers.	E.
Lagerstroemia indica ...	Pride of India	A large ornamental shrub, with pink flowers. Handsome and hardy.	E.
Lavendula vera	Lavender	The well known aromatic shrub with grey foliage.	E.
Ligustrum lucidum ...	Chinese privet	An excellent hedge plant or ornamental shrub or tree. Can be clipped into shape. Liable to die off in patches or lose its lower leaves unless planted in moist soil of fair depth. Propagated from cuttings or seeds.	A.
Lagunaria patersonii ...	—	An evergreen tree with pink flowers, 30 feet high.	E.
Mangifera indica	Mango	The well known fruit tree.	1s. to 2s. 6d. each
Melia azedarach	Syringa	A deciduous tree, producing a good light timber. Shallow rooting. Withstands drought well. Has fine lilac flowers and persistent yellow berries. Suitable for better rainfall areas and deep sandy soil, but will grow under severe conditions.	E.
Morus sp.	Mulberry	A very large fruited variety.	E.

Botanical Name.	Common Name.	Remarks.	Price of transplants.	Price of seed. Lb.	Price of seed. Oz.
Moschosma	Rhodesia spirea	A medium-sized, blue-flowering shrub	E.		
Nerium oleander	Ceylon rose	The Oleander. Salmon-pink, also a white variety. Poisonous.	E.		
Parkinsonia aculeata	Jerusalem thorn	A light foliaged tree, up to 20 feet high, with little yellow flowers, very beautiful as isolated specimen on a lawn.	E.		
Peltophorum africanum	Rhodesian Wattle	Indigenous tree with yellow flowers.	E.		
Persea gratissima	Avocada pear	A tree with an edible fruit. Seedlings only.	2s. 6d. each		
Philadelphus coronarius	Mock orange	A pretty deciduous shrub, large scented white flowers in early spring.	E.		
Photinia japonica	Loquat	A small evergreen tree with large leaves, bearing yellow edible fruit.	E.		
Phytolacca dioica	Belhambra	A rapid-growing, deciduous tree. Useful for ornament. Timber of no value, but seeds valuable as a poultry or cattle feed.	A.	...	pkt. 1s.
Pittosporum undulatum	Camphor laurel	An Australian evergreen shrub, making an excellent hedge, with shining, green, scented leaves and scented berries.	A.		
Platanus orientalis	Plane	Well known deciduous tree up to 30 ft. high. Will stand plenty of frost but apt to lose its leaves prematurely in dry areas.	E.		
Plumiera rubra	Frangipani	A handsome shrub with pinkish red flowers. Rather delicate.	2s. 6d. each		
Plumiera occulata	—	Similar to Plumiera rubra with white flowers. Orange-gold throat.	2s. 6d. each		
Delonix regia	Flamboyant	A handsome red flowering, feathery foliaged tree. Very frost tender. Flowers best on stony ground.	1s. only.		
Poinsettia pulcherrima	Poinsettia	A shrub with small yellow flowers surrounded by many large, scarlet, leaf-like bracts. Very showy. Double and single varieties. Also single pink variety.	E.		
Poinsettia albida	Poinsettia	As above, but with single yellowish white bracts	E.		

Psidium cattleyanum	Purple fruited Guava...	This guava has shiny evergreen leaves and small purple fruit. More useful in the shrubbery than the orchard.	E.		
Psidium pomiferum ...	Guava	A small, hardy, evergreen tree, bearing edible, yellow fruit.	E.		
Punica granatum	Fruiting pomegranate	A shrub or small tree, having shining deciduous leaves, large scarlet flowers and large red fruit. Makes a useful hedge when well cut regularly.	E.		
Punica granatum flora pleni	Double flowered pomegranate	A useful shrub with double scarlet flowers. Does not bear fruit.	E.		
Pyracantha angustifolia	Hawthorn	Fruits golden and hang throughout the winter. Evergreen shrub. Useful as a coarse hedge.	A.E.		
Pyracantha crenulata ..	Hawthorn	Fruits scarlet. Evergreen shrub if watered in winter. Makes a good border or low hedge.	A.E.		
Rhus lancea...	Kárreeboom	A small indigenous tree of graceful appearance, yielding a very durable wood. Useful for ornamental purposes. Forms a fine hedge.	A.E.	10s.	9d.
Russelia juncea...	Coral fuchsia	A pretty red-flowered shrubby plant about 6 feet high.	E.		
Salvia involucrata	Salvia	Shrubby herbaceous perennial, growing to six feet in height. Red flowers. Very suitable for cutting.	E.		
Sapindus mukorossi ...	Soapberry	Fast growing evergreen shade tree of medium height.	E.		
Schinus molle	Pepper tree	A small evergreen tree with pendulous twigs and rose-coloured berries. Enjoys a hot sunny position but will mildew badly in humid heat. Suitable for the drier areas of the Colony only.	E.		
Schrebera sp.	—	An indigenous evergreen shrub with white flowers.	E.		
Spathodea campanulata	African flame tree... ...	A handsome, heavy-foliaged tree, bearing bright red flowers. Suited for the heavier rainfall areas on deep soils. Frost tender.	E.		
Spirea prunifolia	Cape May...	White flowered shrub four feet in height, in single and double varieties.	E.		
Sterculia acerifolia... ...	Australian Flame Tree ..	Medium size deciduous tree bearing masses of scarlet flowers in November.	E.		

Botanical Name.	Common Name	Remarks.	Plants each.	
Sterculia discolor... ...	White Kurrajong	Recommended as a shade tree for the hot dry areas of the Colony.	E.	
Sterculia diversifolia	Black Kurrajong	An evergreen tree up to 30 ft. high with greenish-yellow flowers. Should do well in the hot dry parts of the Colony.	E.	
Streptosolon jamesonii	Streptosolon...	A shrub with orange-coloured flowers in dense masses and pale green foliage. Very frost-tender and delicate.	E.	
Tecoma smithii...	Tecoma	An upright, medium-sized shrub with tubular, bright yellow flowers. Forms a useful hedge. Fairly drought-resistant.	A. E.	... pkt. 1s
Tecomaria capensis ...	Kaffir Honeysuckle ...	A pretty trailing shrub from the Cape, with orange flowers.	E.	
Thevetia neriifolia... ...	Thevetia	An evergreen shrub, bearing bell-shaped, yellow flowers. Hardy. Poisonous.	E.	
Thuya orientalis	Thuya	A very hardy conifer that withstands heat, cold and drought, and does not mind heavy soils. Slow-growing. Of small size. Very good for hedges.	A.E.	... pkt. 1s.
Trichilia emetica	Natal Mahogany	A fine shade tree, evergreen, slow in growth, height to 30 feet, spread up to 50 feet.		1s 6d. to 2s 6d
Vitex Angus-Castus ...	—	A showy blue flowered shrub, does well in the most unlikely places.	E.	
		Climbers and Creepers.		
Ampelopsis veitchii ...	Virginia creeper	Too well known to need description.	E	
Antigonon leptopus . .	Coral Creeper	A showy climber, bright pink flowers, forms large bulbs underground. Takes two or three years to reach flowering size, after this it makes a wonderful display yearly.	E.	

Beaumontia grandiflora	Beaumontia . ..	A large climber with heavy, glossy foliage. Large white, bellshaped flowers. Blooms profusely. Fairly frost-tender.	1s 3d.
Bignonia chrysoleuca ..	Lemon Shower ..	Similar to Golden Shower with lemon coloured flowers. Deciduous.	E.
Bignonia jasminoides ...	—	An evergreen climber with mauve throated white flowers.	1s. 3d. each.
Bignonia tweediana ...	—	A self clinging climber with yellow flowers. Very showy whilst in flower.	E.
Bignonia venusta	Golden shower	Vigorous creeper. Rapid-growing. Bears masses of orange flowers all the year round. Very useful and hardy.	1s. 3d.
Bignonia speciosa	Bignonia	A rapid-growing, showy creeper, bearing large mauve flowers. Decumbent.	E.
Bougainvillaea splendens	Bougainvillaea	Vigorous climber. May be also used as a hedge. Bracts magenta. Fairly frost-hardy.	1s 3d.
Clitoria ternata...	Mussel Shell Creeper ..	A pretty blue flowered creeper but not very strong growing.	E.
Ficus repens...	—	A valuable climber for walls, etc., used in places where the Virginia creeper is grown, but clings to the surface much better than the latter, rather slow at first.	E.
Hedera helix... . . .	Ivy	A dark evergreen climber. Best in shady, cool climates	E.
Jasminum sambac.	Jasmine	A vigorous, evergreen shrub climber with large trusses of fragrant, white flowers.	1s. 3d.
Jasminum primulinum	Climbing jasmine	A yellow-flowering species similar to Jasminum grandiflorum.	E
Lantana salviifolia... ...	—	A fine little creeping shrub with pink flowers, very suitable for rockwork, or edging borders, etc.	E.
Lonicera periclymenum	Honeysuckle (Woodbine)	Hardy climber with sweet-scented yellow flowers.	E.

Botanical Name.	Common Name.	Remarks.	Plants each.
Passiflora edulis	Granadilla	A quick-growing climber, bearing edible fruits. Subject to woolly aphis if overshaded. A good trellis plant.	E.
Podranea brycei	Zimbabwe creeper ..	A rank-growing indigenous creeper with large, pink flowers.	E.
Rhynchospermum jasminoides	Star Jasmine	A white flowered evergreen creeper with strong jasmine perfume. Can be grown as a shrub.	E.
Rosa bracteata.	Macartney rose . .	Plant with large green foliage and numerous white single flowers. Useful as a hedge plant.	1s.
Senecio macroglossus. .	Cape Ivy...	An evergreen ivy leaved climber with yellow flowers.	E.
Stigmaphyllon ciliatum	Buttercup creeper . .	A light evergreen creeper with bright yellow flowers. Does best when growing with other creepers.	E
		Palms, Bamboos, etc.	
Arundo donax	Spanish reed	A reed growing 20 feet to 25 feet in height and 1 inch thick, and very superior to the indigenous variety.	Offsets 1s. 6d. each
Bambusa arundinacea	Whipstick bamboo	About 30 feet.	Offsets 2s. 6d. each
Bambusa sp.	Indian variety	Similar in growth to the Bindura, with very useful rods.	Offsets 2s. 6d. each.
Chamerops excelsa...	Fan Palm	One of the best hardy tall growing fan palms.	2s. 6d. each.
Cyperus papyrus	Papyrus Grass	A very handsome subject for the water garden, or planted near the drip of a tap; it does best when growing in the water.	2s. 6d. each
Oxytenanthera abyssinica	The Bindura bamboo ...	The only variety indigenous to Rhodesia, giving very useful solid rods, very tough.	Offsets 2s. 6d. each.
Phoenix reclinata	Wild date palm.. . . .	A very hardy palm, indigenous to the Colony.	—
Phormium tenax . . .	New Zealand flax ..	A useful green foliaged plant, about 4 feet high with sword-like leaves.	E.
Washingtonia robusta	Fan palm	A strong-growing fan palm. **Palms 2s. 6d. to 5s. each.**	—

Offsets of Bamboos supplied during rainy season only.

SOUTHERN RHODESIA

Locust Invasion, 1932-47.

Monthly Report No. 181: December, 1947.

Red Locust: *Nomadacris septemfasciata Serv.*

No Red Locusts in any stage of development within the Colony were reported.

MERVYN C. MOSSOP,
Acting Chief Entomologist.

Monthly Report No. 182: January, 1948.

Red Locust: *Nomadacris septemfasciata Serv.*

No Red Locusts in any stage of development within the Colony were reported.

MERVYN C. MOSSOP,
Acting Chief Entomologist.

Monthly Report No. 183: February, 1948.

Red Locust: *Nomadacris septemfasciata*, Serv.

No Red Locusts in any stage of development within the Colony were reported.

MERVYN C. MOSSOP,
Acting Chief Entomologist.

Rhodesian Milk Records.

OFFICIAL MILK RECORDS.

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
Criterion Rosalie I.	P.B. Friesland ...	2 year old	9982 00	368 79	3.69	300	J. Jamieson, Box 217, Bulawayo.
Criterion Esther I.	P.B. Friesland ..	2 year old	9105.00	354.57	3.89	300	
Criterion Susanna I.	P.B. Friesland ..	2 year old	7937.00	319 64	4.02	300	
Glow Worm...	P.B. Jersey	Snr 3 year	4941.50	258 83	5 28	300	J. H. Keightley, Moorfields, P.O. Glendale.
Matopo Ruth	P.B. Red Poll ..	Mature	5509 60	216.70	3 91	300	Government Experiment Station, P B. 19K, Bulawayo.
Matopo Star	P.B. Red Poll .	Mature	10220 50	385.21	3 77	300	
Matopo Unique ...	P.B. Red Poll ...	Junior 3 year	8903.60	294.43	3 33	300	
Matopo Olivet	P.B. Red Poll .	Mature	6924.30	219.85	3.18	300	
Matopo Queenlike	P.B. Red Poll ...	Mature	7356.90	287.10	3 90	300	
Matopo Treasure	P.B. Red Poll ..	Junior 4 year	9478.00	330.98	3.49	300	

SEMI-OFFICIAL MILK RECORDS.

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
Limu	G Friesland .. .	Mature	8076.10	286 49	3 55	300	D A Allan, Pendennis, Salisbury.
Fatima	G. Friesland .	Mature	6350.00	232 76	3 67	300	G. R. Anderson, Warrender Farm Box 8, Gwelo.
No. 4	G. Friesland . ..	Mature	7172.00	230 41	3 21	300	
No. 49	G. Friesland ..	4 years	6084.00	230.40	3.79	300	

No. 28 Blackey	G. Friesland	Mature	7370.30	244.50	3.32	300	C. A. Austen, Aspdale Farm, Box 115, Que Que.
Helen	G. Friesland	Mature	6542.60	233.73	3.57	300	
Mabeka	G. Friesland	Mature	6754.30	227.72	3.37	300	
White	G. Friesland	Mature	8103.90	277.79	3.43	300	
Jug II.	G. Friesland	Mature	6444.60	258.94	4.02	300	J. A. Baxter, Box 1368, Salisbury.
D 5	G. Friesland	Mature	9205.90	368.31	4.00	300	A. L. Bickle, Box 595, Bulawayo
D 117	G. Friesland	4 years	8833.00	293.05	3.32	300	
J 67	G. Friesland	Mature	8484.30	278.91	3.29	300	
Sly	G. Afrikander	2 years	5582.50	241.60	4.33	294	
Helenvale Johanna	P.B. Friesland	2 years	8193.40	262.27	3.20	300	
J 47	G. Friesland	Mature	10036.70	332.35	3.31	300	
J 53	G. Friesland	Mature	8692.00	278.21	3.20	300	
D 57	G. Friesland	Mature	7209.80	244.96	3.40	271	
No 74	P.B. Friesland	Mature	10246.80	387.88	3.79	300	
D 83	G. Friesland	Mature	9681.20	337.16	3.48	289	
D 90	G. Friesland	Mature	8091.00	305.61	3.78	266	
D 122	G. Friesland	4 years	6288.00	236.58	3.76	300	
D 141	G. Friesland	3 years	7712.40	264.92	3.43	300	
D 143	G. Friesland	3 years	7064.30	258.73	3.66	300	
D 160	G. Friesland	3 years	7339.80	288.80	3.53	300	
D 170	G. Friesland	2 years	6235.10	272.07	4.36	300	
D 172	G. Friesland	2 years	8082.80	248.71	3.08	300	
No. 58	G. Shorthorn	Mature	5927.00	251.65	4.25	300	P. A. Bowen, Box 893, Salisbury.
No. 95	G. Shorthorn	Mature	5720.00	230.62	4.03	300	
Strawberry	G. Shorthorn	Mature	6256.00	277.04	4.43	300	
No. 96	G. Red Poll	Mature	5401.00	257.50	4.77	280	
No. 32	G. Red Poll	Mature	6059.00	238.20	3.93	293	
No. 69	G. Shorthorn	Mature	5764.00	263.10	4.56	246	
Dirko Jill	P.B. Friesland	Mature	7702.00	279.87	3.63	300	C. Boyd Clark, Castle Zonga, Inyazura
No. 135	G. Friesland	Mature	8362.00	308.76	3.69	265	
No. 195	G. Friesland	Mature	8820.00	313.07	3.55	278	
No. 249	G. Friesland	4 years	6187.00	233.45	3.77	300	
Clara	G. Guernsey	Mature	7419.90	295.31	3.98	300	Miss N. Brereton, Coolmoreen, Gwelo.
Cherai	G. Guernsey	Mature	7113.00	278.08	3.91	300	D. L. Cameron, Lochiel, Ft. Victoria
Mopani	G. Friesland	Mature	6766.40	239.82	3.54	300	
Pandora	G. Friesland	Mature	7640.80	265.90	3.48	300	

SEMI-OFFICIAL.—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
No. 286..	G. Friesland	Mature	7055.00	254.92	3.61	300	Christo & Wilson, Box 110, Gwelo.
Daisy	G. Friesland	4 years	6208 00	241.79	3.89	300	D. J. Coetzee, St. Kevin, P O. Chipinga
Bangle	G. Friesland	Mature	8085.70	279 99	3.46	267	T. Cousins, Oaklands, Gwelo.
Patricia I.	G. Friesland	3 years	7550.10	268 32	3 55	300	
Shamrock I	G. Friesland	2 years	6145.50	227.67	3.70	300	
Surprise	G. Friesland	Mature	6972.00	251.86	3 61	300	Cross & Sons, Box 953, Bulawayo.
Gwelo	G. Friesland	Mature	5746 00	233.08	4 06	258	J. Cumming, Hillside Farm, Norton.
Sitora	G. Friesland	Mature	6208.00	265 14	4 27	300	
Hartjie	G. Friesland	4 years	8118.00	294 96	3 63	299	Daisyfield Orphanage, P.O. Daisyfield.
Juliana	G. Friesland	Mature	7324 60	239.10	3.26	277	
Susie	G. Friesland	Mature	9170 70	326.85	3.56	300	
Organdie I.	G. Friesland . . .	Mature	8460.00	305.87	3 62	300	A. C. de Olano, Blue Water Farm, P.O. Bromley.
Mafunga I.	G. Friesland	Mature	6917.00	251.17	3.63	300	
No. 60	G. Friesland	Mature	6480.30	239.38	3 69	300	J B. Dold, Box 1153, Salisbury.
No. 80	G. Friesland	Mature	6655.70	241.13	3.62	300	
No. 160...	G. Friesland	Mature	8245 80	276.35	3.35	284	
No. 168...	G. Friesland	Mature	7513.70	266 97	3.55	300	
No. 162...	G. Friesland	4 years	7593.20	251 79	3.32	300	
Betty	G. Friesland	Mature	8019.00	281.80	3.51	268	Mrs. M. Everard, Castle Zonga, Inyazura.
Zonga de Grendel	P B. Friesland ..	Mature	7696.00	267 54	3.48	298	
No. 165...	G. Friesland	Mature	7683.00	274.90	3.58	276	
Gilston Nesta	G. Red Poll	4 years	5108 40	239.15	4.68	300	G. N. Fleming, Box 688, Salisbury.
No. 26	G. Friesland	Mature	7694.00	292.41	3.80	300	H. C. Fischer, Olivia Farm, Headlands
No. 239..	G. Friesland	Mature	9081 50	280.59	3 09	300	
No. 261...	G. Friesland	Mature	8772.00	268.97	3 07	300	
No. 279	G. Friesland	Mature	7520.50	296.00	3 94	291	
No. 290...	G. Friesland	Mature	7398 00	266.36	3 60	263	

No. 39	G. Friesland	Mature	8004 00	276 93	3.46	300	R le S. Fischer, Wakefield, Headlands
No. 54	G. Friesland	4 years	10683.00	374.24	3.50	300	
No. 76	G. Friesland	4 years	12957.00	427.01	3 30	300	
No. 185	G. Friesland	Mature	11448.00	345 92	3.02	300	
No. 201	G. Friesland	Mature	10253.00	355 94	3 47	273	
No. 208	G. Friesland	2 years	7838.00	269 99	3.44	300	
No. 228	G. Friesland	Mature	7541.50	264 39	3.51	275	W F Fischer, Coldstream Dairy, Headlands.
No. 444	G. Friesland	Mature	8515.50	311 14	3.65	300	
No. 470	G. Friesland	Mature	7130.50	308.91	4 33	300	
No. 485	G. Friesland	4 years	7014.50	278 05	3 96	300	
No. 500	G. Friesland	4 years	6159 00	262.15	4.26	296	
No. 502	G. Friesland	4 years	6498 50	254.15	3 91	296	
No. 533	G. Friesland	3 years	7275.50	258.55	3.55	300	
No. 356	G. Friesland	Mature	7094 50	265 37	3.74	261	
No. 558	G. Friesland	2 years	6644 50	256.39	3 86	300	
No. 98	G. Friesland	Mature	6540.50	284 88	4.36	300	W. N. Gebbie. P.B. 19A, Salisbury.
No. 117	G. Friesland	Mature	5360.40	231 66	4 32	300	
No. 139	G. Friesland	Mature	5157.90	265 43	5.15	300	
Beatrice	G. Friesland	Mature	10658.00	327 03	3.07	300	Hon. Humphrey Gibbs, Bonisa, Redbank, P B. 52L, Bulawayo.
Harriet	G. Friesland	Mature	7844.00	265.65	3.38	300	
Ivy	G. Friesland	Mature	9779 00	322 21	3 29	300	
Mabel	G. Friesland	Mature	9605.00	299.50	3.12	271	
Norma	G Friesland	4 years	7032.00	226 44	3 22	300	
Polly	G. Friesland	Mature	6056.00	333 25	3 85	300	
Rene	G. Friesland	Mature	6650 00	261.36	3 93	276	
No. 177	G. Red Poll	4 years	6945.40	278.92	4 02	300	Govt Experiment Station, P.B. 19K, Bulawayo.
No. 25	G Jersey	Mature	5850.90	249 63	4 23	300	R. H. Greaves, Fountain, Nyamandhlovu.
Electra D.184	G. Friesland	2 years	6870 40	234 44	3 41	300	E E. C. Green, Box 879, Bulawayo.
Empress D.185	G. Friesland	2 years	8256.20	297.57	3.61	300	
Bickle	G Friesland	4 years	7006.50	250.39	3.57	300	R. J. Green, Hertford Farm, Box 443, Bulawayo.
Trousers	G. Friesland	Mature	6650.00	235.99	3 55	300	
Primrose	G Guernsey	4 years	5972.40	269 96	4 52	280	D A. Harley, Harleyton, P.O. Beatrice
Sheila	G Guernsey	Mature	6438.30	274 76	4 27	273	
Spotted Pearl	G Guernsey	Mature	5475 80	227 14	4 15	287	
Susie	G Guern /Fries	3 years	6071 10	249 11	3.95	300	
Thelma	G. Friesland	Mature	7466 40	311 34	4 17	300	

SEMI-OFFICIAL—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B Fat.	No. of Days.	Name and Address of Owner.
Kofman	G. Friesland	Mature	6568.20	231.11	3 52	300	Mrs. C. Harrison, Box 58, Shamva
Belinda	G. Guernsey	2 years	5875.10	270.33	4.60	300	Mrs L. M. H. Howard, Nengwa Farm, P.O. Beatrice.
Pam	G. Friesland	2 years	7716 30	276 22	3 58	300	D. J. Huddy, Box 718, Salisbury.
Nellie	G. Friesland .. .	Mature	9324 00	382.21	4.10	300	
Driekol II.	G. Friesland	Mature	7894.20	310.63	3 93	295	
Flossie...	G. Friesland	Mature	7024.40	267.13	3.80	245	
Belinda	G. Friesland	4 years	6929 00	255.08	3.68	261	
Grumpy	G. Friesland	4 years	6912.10	244.34	3.53	300	
Koffie	G. Friesland	Mature	6679.00	242.56	3 63	231	
Lulu	G. Friesland	4 years	7998.30	264 49	3.31	245	
Merry	G. Friesland ..	Mature	10223.40	355.36	3.48	300	
Stella	G. Friesland ...	4 years	7694.40	313.61	4.08	300	
Vixen	G. Friesland ...	Mature	6751 00	244 53	3 62	239	
America	G. Friesland	Mature	7029.30	231.17	3.29	300	L. Huddy, Box 924, Salisbury.
Brenda...	G. Fries./Guern.	Mature	7482.00	302.93	4 05	300	Mrs.M R. Huddy, Hopley Farm, Box 899, Salisbury.
Mona	G. Guernsey	Mature	7377.00	306 09	4.15	300	
Pansy	G. Guernsey . .	Mature	6297 00	268 52	4.26	300	
Avis	G. Guernsey .. .	Mature	5551 00	249 41	4 49	298	
Chips	G. Guernsey	Mature	5924.00	231 94	3.92	277	
Jessie	G. Friesland	Mature	7766 50	333 27	4 29	300	
Maud	G. Shorthorn	Mature	6780.00	236 46	3.49	294	
Queenie	G. L.R./Shornhorn	Mature	5508 00	263.81	4 79	300	
Pretoria	G. Friesland	Mature	6950.10	232 40	3.34	300	Mrs. Y. V. Russel James, Mazarita, P O. Gatooma.
No. 1	G. Friesland ..	Mature	9090.00	341 73	3 76	300	D S Kabot. Box 261, Bulawayo.
No. 6	G. Friesland ..	2 years	8118.00	328 96	4.05	300	
No. 13	G. Friesland . .	Mature	10263.00	393.31	3.83	300	
No. 21	G. Friesland	Mature	6621.00	315.16	4.76	300	
No. 29	G. Friesland	4 years	13373.00	477 31	3.57	300	
No. 36	G. Friesland	Mature	13941.00	455.58	3 26	300	
No. 37	G. Friesland	Mature	12023.00	414.02	3 44	300	
No. 38	G. Friesland	Mature	8736 00	304 55	3 49	300	

No. 44	G. Friesland	3 years	8845.00	344 18	3.89	300	D S. Kabot, Box 261, Bulawayo.
No. 45	G. Friesland	Mature	10696.00	339.63	3.18	300	
No. 64	G. Friesland	Mature	7565.00	258.82	3.42	300	
No. 71	G. Friesland	3 years	10138.00	442 98	4.37	300	
No. 79	G. Friesland	Mature	10635 00	420.87	3.96	300	
No. 85	G. Friesland	Mature	13334.00	468 22	3.51	300	
K. 6	G. Friesland	Mature	6593.40	253 67	3 85	300	B. H Kew, Box 972, Bulawayo.
K. 24	G. Friesland	4 years	7374 70	268 13	3.64	300	
No. 10	G. Friesland	Mature	8089.00	302.21	3.74	300	
No. 11	G. Friesland	Mature	7261 10	262.18	3 61	300	
K. 19	G. Friesland	4 years	7823.60	267.48	3.42	300	
No. 16	G. Fries/Shorthorn	Mature	9978.60	379.02	3 79	300	
D 14	G. Friesland	Mature	8335.00	265 08	3 18	261	
Ouma	G. Jersey	Mature	5868 60	279 72	4.77	241	E M Kok, Everton, Inyazura
No. 13	G. Shorthorn	4 years	5975.50	233.66	3.91	300	H T. Lay, P.B 107C, Salisbury
Whinburn Dew	P.B. Friesland	Mature	9015 00	338.99	3.76	300	J N L. MacIlwaine, Box 23, Marandellas.
Zonga Queen 6th	P.B Friesland	4 years	6213.00	243.10	3.91	300	
Gladys	G. Common	Mature	5151.00	231.39	4.50	295	J Mares, Julius Dale, P B. Rusapi
Pitch	G Aber/Angus	4 years	7493 90	296 57	3.96	259	C J Marshall, Box 654, Bulawayo
Rusty	G Aber/Angus	3 years	5919 80	228 19	3 85	300	
No. 20	G. Friesland	Mature	8482.30	314 85	3 71	300	D W. Marshall, Box 164, Umtali.
Etta	P.B. Friesland	4 years	5319.50	270.26	5.08	300	G. M. B Maunsell, Forres, Bromley
Barbari	G Jersey	3 years	6135.40	286.36	4.67	300	Lt-Col. C I F Maynard, Melfort, P B 112C, Salisbury
Daisy	G. Common	4 years	6527 80	327 26	5 01	300	
Makwin	G Jersey	Mature	7110.40	322.59	4.54	300	
Nimbi I.	G. Jersey	Mature	6111.70	289.16	4.73	300	
Noratu	G. Red Poll	2 years	8018 40	308.93	3.85	300	
No. 354	G. Guern./Fries	Mature	8036 30	295 53	3 68	300	J R McLaren, Safago, Gwelo.
No. 368	G. Guernsey	Mature	9154.90	382.16	4 17	300	
Poll	G. Red Poll	3 years	5782.50	234.13	4.05	300	
No. 332	G. Guern./Fries.	Mature	9748.00	325.06	3.33	300	
No. 400	G. Guern./Fries.	Mature	6734 20	249.48	3 70	259	
No. 439	G. Guernsey	4 years	8596 40	328.74	3 82	300	
No. 446	G. Guernsey	3 years	5906.00	241.86	4 10	300	

SEMI-OFFICIAL—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner
No. 7	G. Friesland	2 years	6119.40	256.14	4 19	300	J. H. McLean, Box 161, Gwelo.
Babs	G. Ayrshire . ..	Mature	5078.50	233.51	4.60	258	
Browndale	G. Common	Mature	6534.60	267.50	4.09	300	
Drika	G. Friesland	Mature	9221.90	303.53	3 29	300	
Gugwa	G. Friesland	4 years	8271.50	307.25	3.71	300	
Knykop	G. Ayrshire	Mature	5848.90	238.77	4 08	239	
Molly	G. Friesland	3 years	8390.30	275.30	3.28	300	
Shortie No. 1	G. Friesland	Mature	6001 80	232.48	3.87	300	
Sparg	G. Friesland ..	Mature	7866.00	335.32	4.26	300	
Skin	G. Friesland .. .	Mature	7516.60	282.82	3.76	300	
Tiny	G. Friesland	2 years	6218.60	248 68	4.00	300	
Vaseline	G. Ayrshire	Mature	5709.90	244 10	4.28	300	
Nyamane No. 4 ...	G. Friesland	Mature	6943.10	272.97	3.93	266	L. McLean, Box 161, Gwelo.
No. 17	G. Friesland	4 years	6348.80	254.57	4 01	263	
No. 35	G. Guernsey	2 years	5575.90	226.72	4 07	300	
G 2/1	G. Friesland . .	Mature	8613 00	327 75	3 81	300	Meikles Trust & Invest. Co, Ltd., Leachdale, Shangani,
P 13/2	P.B. Friesland ...	4 years	6545.00	246.91	3.77	300	
G 18/2	G. Friesland	4 years	8722.00	312.30	3 58	300	
Ida	G. Red Poll .	Mature	5955.00	242.60	4.07	300	C F. Mitchell, Manzana Farm, Essexvale.
Queenie	G. Red Poll	Mature	6952 00	249.99	3 59	300	
Mitchlin Destiny	G. Friesland	3 years	9801.00	336.44	3.43	300	W. S. Mitchell, Springs Farm, Iron Mine Hill.
Surprise IA	G. Friesland . . .	Mature	9390 00	296 48	3.16	300	
Martha	G. Friesland	Mature	7411.60	270.87	3.65	300	Commander E. L. Morant, Box 741, Salisbury.
Bess	G. Friesland	2 years	6900.00	244 57	3.54	300	C. F. S. Morkel, Two Streams, P.O. Macheke.
Crescent	G. Friesland	2 years	6185.00	275.66	4.46	300	
Irene	G. Guernsey	Mature	6014.00	253 61	4.22	285	G. R Morris, Box 1040, Salisbury.
Cherry...	G. L.R. Shorthorn	Mature	6525 00	248 58	3.81	300	
Grace	G. Guernsey	Mature	6360.00	247.01	3.88	300	

No. 36	G. Friesland	Mature	8157 00	257.14	3 15	300	F. B. Morrisby, Box 36, Gwelo.
No. 135	G. Friesland	Mature	8456.00	270.68	3.20	300	
No. 133	G. Friesland	Mature	8579.00	258.90	3.02	300	
No. 138A	G. Friesland	Mature	8332.00	296.24	3.56	300	
White	G. Friesland	Mature	5795.00	229.43	3.96	300	Mutambara Mission, P O. Mutambara.
Emma	G. Friesland	Mature	5737.00	227.89	3.97	299	
Birnie	G. Friesland	4 years	5838 00	229.08	3.92	252	Kenneth Norvall, Box 637, Bulawayo.
Cape Town	G. Friesland	3 years	6554.00	248.51	3 79	300	
Dulcie I.	G. Friesland	3 years	6049.00	228.22	3 77	300	
Evelyn II	G. Friesland	2 years	7145.00	247 56	3.46	280	
Exwell Betty I.	P.B. Friesland	3 years	8164 00	315 76	3.87	300	
Katie of Cartrep	P.B Friesland	Mature	11795 00	361.44	3.00	251	
Luveve	G Friesland	4 years	5623.00	239.89	4.27	300	
Ndhlovu	G. Friesland	Mature	6973.00	237 02	3 40	300	
Sausage	G. Red Poll/Fries.	Mature	8405.00	332 38	3 95	275	
Turkey	G Friesland	4 years	8042.00	305 51	3 80	300	
Exwell Marie III.	P.B. Friesland	Mature	8787.00	343 78	3 91	291	
Bell	G Friesland	Mature	12675.10	435 10	3.43	275	E Palmer, Ferndale, Penhalonga.
Katie	G Friesland	2 years	6740 80	252 79	3.75	300	
Maisie II	G Shorthorn	4 years	7601 30	323 65	4 26	245	
Susan	G. Friesland	Mature	6133 50	230 31	3.75	252	
Baby	G Friesland	3 years	8473.50	276.85	3.26	295	Mrs M. Parsons, Weltevrede Dairy, Box 7, Bulawayo.
Dans	G. Friesland	Mature	12976 50	450 87	3 47	300	
Ivy	G. Friesland	Mature	10022 00	361 00	3 60	300	
Scotch	G Friesland	Mature	12686 00	470.24	3 70	300	
Bye and Bye	G. Friesland	Mature	7921 50	295.04	3 72	300	
Dassie	G. Friesland	3 years	11156.00	413 62	3.70	300	
Edna	G. Friesland	Mature	12920.00	434 77	3 37	300	
Madge	G. Friesland	2 years	10235.50	360.95	3 53	300	
Petunia	G Friesland	Mature	8831.50	295 23	3 34	300	
Spoor	G Friesland	Mature	8170.00	284.52	3.48	300	
Stella	G. Friesland	2 years	7434.50	245.12	3 30	300	
Surprise	G. Friesland	Mature	10733.00	384 03	3.58	300	
Vetkop	G. Friesland	Mature	13377.00	412 93	3.01	300	
No. 42	G. Friesland	Mature	7024.00	240.98	3 43	284	T C Pascoe, Box 1253, Salisbury.
No. 61	G Friesland	3 years	6733 90	276.30	4.10	300	
No. 74	G Friesland	Mature	10005 00	342.27	3 42	300	
No. 106	G. Friesland	Mature	8085 90	291 30	3 60	300	
No. 109	G. Friesland	Mature	6767 00	246 62	3.64	300	

SEMI-OFFICIAL—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
No. 133	G. Friesland	Mature	8887 00	346.38	3.90	300	T C Pascoe, Box 1253, Salisbury.
No 137	G. Friesland	Mature	5458 50	233 32	4 27	281	
No. 201	G. Friesland	Mature	5962.60	234 18	3 93	300	
No. 49	G. Shorthorn	Mature	7344.60	258 38	3 52	300	
No. 84	G. Friesland	Mature	7261.30	273 92	3 77	289	
No 136	G. Friesland	Mature	6521 70	247 51	3.80	300	
No. 200	G. Friesland	3 years	6974 90	285 41	4.09	300	
No. 3	G. Friesland	Mature	8727 00	291 84	3 34	300	J Picken, Iron Mine Hill Farm, P.O. Iron Mine Hill.
No. 4	G. Friesland	Mature	10214 00	388 29	3.80	300	
No. 25	G. Friesland	Mature	6731 00	247 04	3 67	300	
No. 60	G Fries./Red Poll	Mature	7407.00	236.60	3 19	272	
Zimbabwe	G. Friesland	Mature	6499.00	248 12	3 82	300	Mrs. S. Worthington Reed, Box 19, Gwelo.
Daisy	G. Friesland	Mature	7213 00	279 38	3 87	270	Rhodesian Corporation Ltd., Kent Estate, P O. Norton.
Ivy	G. Friesland	Mature	6150 00	298.49	4 85	290	
Lavender	G. Friesland	Mature	7420 00	283.70	3 82	272	
Nellie	G. Friesland	Mature	7045 00	241 86	3 43	290	
Primrose	G. Friesland	Mature	7435 00	237 51	3 19	273	
Betty	G. Friesland	Mature	6141.10	225 64	3.67	300	Mrs. M. Rogers Bickford, Gwelo.
Fanizo	G Friesland	Mature	8346.70	270 45	3 24	300	W. F. H. Scutt, Maple Leaf, Norton.
Gosam	G. Friesland	Mature	9570.60	294 13	3 07	300	
James	G. Friesland	2 years	5976 10	254 65	4.26	300	
Luben	G. Friesland	2 years	6685.50	262 51	3 93	300	
Lumankiyo	G. Friesland	3 years	8230 30	324 50	3 94	300	
Vinyu	G. Friesland	Mature	6664 50	251 35	3.77	300	
Stekkish II.	G. Friesland	Mature	6311.00	264.31	4 19	300	E. Stanger, Chimbi Source, Rusapi.
Blanco	G. Fries./Guern.	Mature	6248 00	244 94	3 92	300	Mrs V. Stead, Ascot Estates, Box 56, Gwelo.
Dulcie I.	G. Friesland	Mature	7780 60	281 40	3.62	283	
Musk	G. Friesland	2 years	6150 80	254.36	4 14	300	

No. 5	G Ayrshire	Mature	7869.00	283.88	3.61	300	J. R Stewart & Son, Battle Farm, P.O. Shangani.
No. 11	G Ayrshire	Mature	7001.00	264.81	3.78	231	
G.12	G Ayrshire	Mature	10771.00	371.89	3.45	300	
Dorothy	G Friesland	3 years	8393.00	303.40	3.62	300	Susman & Newfield, Box 323, Salisbury
Mary	G. Friesland	Mature	7309.00	275.93	3.78	300	
Pinafore	G. Ayrshire	Mature	6150.00	261.35	4.25	300	
Sole	G. Friesland	3 years	5899.00	229.26	3.89	300	
Crump	G. Friesland	Mature	6723.80	232.31	3.46	300	H Swaine, Box 131, Gwelo.
Kaatjie	G. Friesland	Mature	6971.70	233.00	3.34	300	
Mankosi	G Friesland	Mature	6693.30	237.56	3.55	300	
Aster	G. Friesland	3 years	7434.00	271.82	3.65	300	E. Tapson Trust Ltd., Lesape Falls, Rusapi
Betty	G. Friesland	3 years	6383.00	263.38	4.13	272	
Chichaka	G. Friesland	Mature	7854.00	256.26	3.26	283	
Cynthia	G Ayrshire	Mature	5913.00	251.00	4.24	260	
Djonifa II.	G Friesland	Mature	7131.00	294.09	4.12	244	
Enya	G Ayrshire	Mature	7876.00	334.79	4.25	290	
Esther	G Friesland	2 years	5748.00	231.26	4.02	300	
Framissina	G. Friesland	Mature	8020.00	271.29	3.38	285	
Girida III	G Ayrshire	3 years	6088.00	247.08	4.06	300	
Gunda	G Ayrshire	4 years	6180.00	228.49	3.70	290	
Gushure	G. Friesland	Mature	8287.00	281.45	3.40	300	
Jakajaka II.	G. Friesland	Mature	7203.00	274.10	3.81	300	
Jasmine	G. Friesland	Mature	6973.00	234.71	3.37	300	
Marion	G. Friesland	4 years	5909.00	236.29	4.00	300	
Matense I.	G. Friesland	Mature	6658.00	227.42	3.42	300	
Mrefu	G Friesland	Mature	6966.00	236.68	3.40	239	
Newlands	G. Friesland	Mature	7548.00	269.93	3.58	300	
Phoenix	G Ayrshire	Mature	6767.00	281.45	4.16	300	
Snowdrop	G. Friesland	Mature	8979.00	287.46	3.20	260	
Takasinga	G. Friesland	Mature	7558.00	254.79	3.37	300	
Teresy	G Red Poll	Mature	6622.00	267.68	4.04	252	
Home Farm	G Friesland	Mature	8024.00	364.63	4.54	266	Est Mrs J. G Taylor, Box 55, Selukwe
Peanty	G Friesland	Mature	6612.40	269.13	4.07	300	A. W. Tennent, Kelvin, Headlands
Boy	G Friesland	Mature	6515.30	257.22	3.95	277	
Cissy	G Friesland	3 years	6529.00	234.54	3.59	300	
Connie	G Friesland	3 years	7953.40	295.96	3.72	300	
Cumming	G. Friesland	4 years	6848.70	284.35	4.15	300	
Eva	G Friesland	3 years	6579.90	248.55	3.78	300	
Ghenna	G Friesland	Mature	5681.60	226.88	3.99	244	

SEMI-OFFICIAL—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
June	G. Friesland	Mature	6079.40	239.11	3.93	271	A. W. Tennent, Kelvin, Headlands.
Maggie	G. Friesland	Mature	6843.40	258.32	3.77	287	
Mask	G. Friesland	Mature	6266.30	252.84	4.03	300	
Nkana	G. Friesland	Mature	6132.50	241.56	3.94	300	
Pat	G. Friesland	Mature	6671.20	259.93	3.90	253	
Polly	G. Friesland	Mature	5809.20	231.65	3.99	266	
Rosie	G. Friesland	Mature	6868.80	286.76	4.18	293	
Sarah	G. Friesland	Mature	8207.30	343.85	4.18	300	
Sheena	G. Friesland	3 years	6656.20	260.71	3.92	300	
Winnie	G. Friesland	4 years	6094.40	236.49	3.88	268	
Xmas	G. Friesland	Mature	7277.80	256.47	3.55	300	
No. 11	G. Friesland	2 years	6016.70	236.69	3.93	300	
Camoter	G. Red Poll	Mature	5160.90	225.01	4.36	300	J. G. Thurlow, Atherstone, Bindura.
Nyagoi	G. Red Poll	Mature	5830.30	245.47	4.21	221	
Nyasaland	G. Shorthorn... ...	Mature	6837.90	278.03	4.07	282	
Sinoia II.	G. Red Poll	Mature	5420.80	245.19	4.54	291	
Magaba I.	G. Friesland	Mature	5505.20	232.65	4.23	277	R. Thwaites, Stow, Marandellas.
Razor	G. Friesland	Mature	4888.90	233.08	4.77	261	
Annie	G. Friesland	3 years	6129.30	227.27	3.61	300	Mrs. M. Turnbull, Box 479, Bulawayo
Buttercup	G. Friesland	Mature	8319.70	305.73	3.67	300	
Emma	G. Friesland	3 years	7886.20	263.50	3.34	300	
Peggy	G. Friesland	3 years	7212.00	268.30	3.72	302	
Tiny	G. Jersey	2 years	6904.80	248.73	3.60	305	
B.B.	G. Afrikander	Mature	6263.30	287.68	4.59	273	C. G. Tracey, Handley Cross, P.B. Gatooma.
No. 95	G. Red Poll	Mature	7427.00	241.34	3.25	300	A. M. Tredgold, P.B. 61L, Bulawayo.
Mary III	G. Friesland	Mature	6533.00	251.63	3.85	300	Miss I. van Niekerk, Claremont Farm, Inyanga, P.B. Rusapi.
Mary Isabelle	G. Friesland	Mature	7163.00	258.41	3.61	300	

THE RHODESIA
Agricultural Journal

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Editorial

Notes and Comments

WITCH WEED

The menace of this very serious parasite of the maize plant has never been greater than it is to-day, or so great.

The increasing shortage of labour means that many maize growers are no longer able to keep the pest under proper control by hand cultivation.

When it is realised that each seed capsule contains about 300 seeds, and that a well-grown plant may produce many hundreds of thousands of seeds, it will readily be realised how rapidly this terrible curse can increase in number if only *one* "crop" of the parasite is allowed to mature seed in one season.

Maize farmers whose farms are infested are advised *immediately* to replace the green manure crop in their rotations with two trap crops, and in addition to adopt a wide-spacing between the rows of maize that will allow the parasites in between the rows to be killed mechanically right up to the time the pest is killed by the first frost. There are several light tractors on the market of from 6 to 10 h.p. suitable for this work.

Bulletin No. 1310, obtainable from the Department of Agriculture, describes the methods recommended for trap-cropping. but it is desirable to mention here that Amber Cane may, under present circumstances, prove an even cheaper home-grown seed than Rhodesian Sudan grass. Only some 5 to 7 acres of seed plot under Amber Cane are required per 100 acres of land to be trapped twice in one season. It is, of course, very poisonous to stock in the early stages of growth, but this is a risk that the maize farmer must now face and guard against. Sown in 30-inch rows through a kaffir corn plate, only some 4 to 5 lbs. of seed are required to sow one acre. The cost of seeding the nursery is therefore very low. The seed crop can be reaped by mowing machine.

The seed should be treated in the same way as maize in order to guard against smut, a disease of the flowering head.

Experiments carried out at the Agricultural Experiment Station, Salisbury, over some six years proved conclusively that two traps sown and killed *at the proper time* in one season are equivalent in manurial value to a crop of sunn hemp *sown early*, and they should therefore give results some 14 per cent. better, as judged by the yields of the two following maize crops, than a sunn hemp crop *sown late to avoid the beetles*. These experiments were carried out on witch weed-free land, and the farmer trap-green manuring infested land will naturally receive very much greater benefits from the change-over according to the severity of the infestation by the parasite.

It will be apparent to the experienced farmer that the twice trapping in one season of several hundred acres of land calls for mechanisation. A satisfactory outfit for every 200 acres to be twice trapped in one season is a suitable tractor, and a six-foot cut "one-way disc," "multiple disc plough," or "disc tiller," fitted with a combined seed and fertiliser box. With this outfit a farmer can carry out all the operations of trap-green manuring. It will cover an acreage of at least 20 acres in a day, and if fitted with headlights the acreage worked can be increased by 50 to 100 per cent. in emergencies.

The application of the phosphatic fertiliser intended for the following maize crop should be applied to the first trap crop since this, by stimulating the growth and spread of the root system of the two crops, will materially assist them to germinate the maximum number of the seeds of the parasite. Rock phosphate is very suitable for this purpose, and it will be held in the soil for the use of the maize crop.

We are of the opinion that, if steps similar to those outlined above are not immediately taken by farmers whose lands are infested with the parasite, in a year or two they will no longer be able to grow maize profitably, to the serious loss of themselves and the community in general. Moreover, the rapid development of Southern Rhodesia depends very largely on an ample maize crop, and no emphasis of this is needed.

PROVISIONAL ESTIMATE OF ACREAGE UNDER CROPS, 1947-1948 SEASON.

	Actual Acreage, 1946-47.	Estimated Acreage, 1947-48.	Increase (+) or Decrease (–) (acres)
Maize	251,806	335,000	(+) 83,194
Tobacco—			
Virginia flue-cured ..	90,757	116,700	(+) 25,943
fire-cured .	1,385	1,400	(+) 15
Turkish	11,811	10,200	(–) 1,611
Cotton	1,921	4,250	(+) 2,329
Groundnuts	8,413	10,500	(+) 2,087
Green Manure Crops ...	85,338	118,000	(+) 32,662
Potatoes (Summer Crop)	3,537	3,800	(+) 263

It will be seen from the above figures supplied, by the Statistical Department, that our farmers have made a really fine effort, under difficult conditions, to increase crop production. They have increased the acreage under the above crops by an estimated 146,493 acres, and only in the case of Turkish tobacco has there been a reduction in acreage. At the same time, the acreage under soil restorative crops has been increased by 32,662 acres.

FARM MECHANISATION.

A party representing the Department of Agriculture, the Rhodesia National Farmers' Union and the Food Advisory Committee recently visited Charter Estate, in the Enkeldoorn District, to inspect the results obtained by Mr. H. Struckel with his methods of mechanising maize production up to the stages of reaping the crop.

The type of soil on which the 400 acres of maize concerned is growing, varies between a light and a heavy sandy loam derived from the Forest Sandstone formation, which is eminently suitable for withstanding the passage of heavy implements and tractors without the latter causing undue damage to the structure of the soil. For instance, during the nine days prior to the visit, seven inches of rain had fallen, yet the soil over the whole 400 acres was in condition to be worked over by tractors.

Mr. Struckel's methods were simple and may prove of great interest to other farmers. Briefly, the tractor drew two two-row planters of which only the two outside seed boxes were operated. Two rows were, therefore, planted at a time, and a spacing of 6 ft. 6 ins. between the rows and a spacing of 10 ins. in the rows was aimed at.

The actual spacing obtained between plants in the row was nearer 12 ins. than 10 ins. according to an experienced observer. This would give a plant population per acre of about 6,700 instead of the normal population for Mashonaland of about 9,680. The wide spacing in the row was no doubt due to using planters for ox-draft behind a tractor that travels much faster than the pace of the ox, but a large drop in yield can be expected.

For instance, in maize spacing trials covering six years at the Salisbury Experiment Station, a drop in plant population of 868 (from 9,680 to 8,712) caused a drop in yield of grain of 1.08 bags per acre, or 6.2 per cent. Nevertheless, we must bear in mind that the farmer may get a crop worth reaping using Mr. Struckel's methods, despite the reduction in yield, whereas if he has to leave the maize and weeds to fight it out, owing to lack of labour, he may reap no crop at all.

Thereafter, only two cultivations by disc-harrow were required to control the weeds, and no hand labour on this work was necessary. For the first cultivation the disc-harrow straddled the rows so that the soil was worked inwards on to both sides of the row of plants so that it formed a small ridge covering the bases of the stems of the maize plants that assisted to control soil erosion, as well as smothering young weeds in the row.

At the second cultivation the disc-harrow worked between the rows of maize so that the soil was thrown back towards the centre of the inter-space. At each of these two cultivations 40 acres were covered in a day.

One European drove the tractor assisted by two natives, and a third native was employed in filling in the blanks.

So, in the result, one European aided by two natives planted and kept free from weeds 400 acres of maize—a notable achievement.

We fear, however, that on the sticky, heavy soils in some areas of the maize belt, farmers would hesitate to use a disc-harrow for their cultivation. On many farms, too, it is doubtful whether the two disc-harrowings would control the weeds effectively.

In the next (March/April) issue of this journal we propose to give a description of the methods of mechanising the cultivation of the maize crop, which have been in use there for the past two years. But it may be mentioned now that a tractor drawing four sections of spring-tooth harrow cultivated 85 acres per day as compared with the 40 acres per day covered by Mr. Struckel's outfit. This naturally reduces greatly the proportion of the land packed by the tractor wheels. But at least one hand-cultivation has been necessary for good weed control in the rows.

We are also aware that a number of farmers in the maize belt have completely mechanised the growing of the crop up to the reaping stage, and we cordially invite them to supply us with a description of their methods for publication in this journal for the benefit of their fellow farmers. These can, of course, be published anonymously if this is desired.

STAR BUR WEED.

In an article by "Food Farmer" in "The New Rhodesia" of 2nd April, 1948, a plea is made for the removal of the Upright Star Bur (*Acanthospermum hispidum*, D.C.) from the schedule of noxious weeds because of its check to erosion. It might be well, therefore, to remind readers that this plant was removed from the noxious weed schedule by Government Proclamation No. 19 of 23rd May, 1947, together with the following other weeds:—Prostrate Star Bur (*Acanthospermum australe* (L.), O. Ktze.), Mexican Poppy (*Argemone mexicana*, L.) and all species of Cockle Bur and Burweed (*Xanthium*, Spp.).

The removal of Upright Star Bur from the schedule was made largely for the reasons stated by "Food Farmer" in his article, although the position of this weed is still under review by a Noxious Weeds Sub-committee of the Department of Agriculture and information is still being gathered and research carried out on the harmful nature or otherwise of this plant.

MAIZE AND NITROGEN.

A number of Farmers' Associations have made visits to the Salisbury Experiment Station and the Government Farm, Gwebi, primarily to inspect work being done in connection with the breeding and production of "hybrid" maize. Many of them have remarked on the prevalence this season throughout the maize belt of the premature yellowing and death of the bottom leaves of the maize, in most cases affecting all the plants in a whole field. The tentative explanation for this offered by the Agricultural officials present, namely, that it is almost certainly due to shortage of nitrogen, is borne out by an extremely interesting experiment commenced this season on the Salisbury Experimental Station.

Briefly, in this experiment 150 lbs. or 300 lbs. per acre of various phosphates is applied to the second maize crop following green manure. In addition, on half of each plot sulphate of ammonia at the rate of 250 lbs. per acre was applied at the time when the first few tassels were appearing. This was broadcasted between the rows and lightly covered with soil.

In every case where the sulphate of ammonia was applied (including the control plots that received no phosphate) there has been no premature yellowing of the bottom leaves, but on every other plot this phenomenon was most marked. Moreover, the promised increase in yield of maize (as judged by eye early in April) as a result of the late application of sulphate of ammonia appears to be very high.

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This organisation formed by the Governments of the British Commonwealth provides up-to-date information in the form of abstracting and reviewing journals, technical communications and bibliographies on all aspects of science and practice as applied to agriculture, horticulture, and forestry.

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Owing to increased costs of production, the subscription rates for most of the journals of the Commonwealth Bureaux have been increased. The new rates for *Forestry Abstracts* and *Forest Products and Utilisation*, which will come into force in May, 1948, have not yet been decided.

All correspondence regarding above journals and other publications may be addressed to:—

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Mycological Notes

THE FEW BROWN KERNELS IN YOUR MAIZE SEED.

By J. C. K. HOPKINS, D.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Plant Pathologist.

[In view of the importance of the maize crop to the Colony and the urgency of increasing yields per acre under present conditions of food shortage, the following article, published in this Journal in July, 1929, is reprinted for the information of maize growers in general and members of the Seed Maize Association in particular. It illustrates the danger of selecting seed from any cob with visible discoloration.]

In the June issue of this Journal a general description was given of Diplodia in maize, when it was explained that the most serious phase of the disease was the reduction in stand caused by planting infected seed. It was pointed out that seed selection held an important position amongst control measures to be adopted, and it was particularly emphasised that all selected cobs should be free from discoloration of any kind; the most perfect show points should be entirely offset by the presence of a few brown kernels and the cob discarded. Some additional remarks were made about these few brown kernels, and it would be interesting to know how many readers gave them their serious consideration. For the benefit of the sceptical, we are this month publishing a few figures obtained from experiments carried out in the field and the mycological laboratory.

Since reaping commenced this season a considerable number of counts have been made of Diplodia-infected cobs found in the mealie cribs of farms in different districts. There was found to be wide variation between individual farms, but the average infection of counts of 200 cobs per farm, taken at random from heaps of reaped mealies, is just under 50 per cent., 48.7 per cent. being the actual figure. A number of cobs in various stages of disease were brought into the laboratory and counts made of kernels from cobs which would probably have been selected for seed. Some interesting facts were brought to light with regard to the *few brown kernels* already referred to. Here is the analysis of a really excellent cob grown on light contact soil, and which few farmers could resist when selecting seed:—

Length	9½ inches.
Diameter—	
Two inches from tip	6¾ inches.
Two inches from butt	7½ inches.
Weight (dry)	1 lb. 3½ ozs.

Rows straight, no false grains, and kernels closely set and of good shape, BUT—

Eight seeds at tip showed the typical brown and pinkish discoloration due to Diplodia.

The cob was shelled row by row and each row laid out on a sheet of cardboard so that the complete cob could be viewed, as it were, from the inside. The picture, to the farmer who would have selected this cob for seed, would certainly have been startling, for it was immediately obvious that visible infection had spread from the tip down as far as the twenty-seventh row, nine rows only—at the butt end—containing no discoloured grain. A count of the seeds showed that out of a total of 311 there were 174 visibly infected by Diplodia—that is, 55.9 per cent. From the remainder, which were apparently clean, 50 seeds were placed in a germinator and 34 developed a mouldy growth of Diplodia, indicating that, although showing no discoloration, they were infected by the fungus. Several similar cobs were treated in the same way and much the same results were obtained, whether the infection was at the tip or the butt, which illustrates quite clearly the insidious nature of Diplodia and the importance which should be attached to the *few brown kernels.*

Cobs which were more heavily infected, showing a brown discoloration for a distance of from one to one and a half inches from tip to butt, were also examined. The discoloured seed was removed as in the usual process of tipping and butting, and representative samples of the remainder were placed in germinators. The average of four cobs tested showed a visible infection of 51.6 per cent. and a total infection of 71.6 per cent. Thus 20 per cent. of the seeds were apparently clean but carried Diplodia infection and these would probably respond to seed treatment, but of the 51.6 per cent. discoloured grain, a large proportion was too far rotted to obtain any benefit.

WHAT ABOUT SEED SELECTION NOW ?

Cheese Making in the Home

By THE DAIRY BRANCH.

(Bulletin No. 1276 reprinted.)

Although the facilities necessary for the production of factory cheese are not to be found in the average homestead, nevertheless it should be feasible by exercising the necessary care to manufacture cheese of quite acceptable quality in the home, and most of the equipment required can usually be improvised from articles to be found in the kitchen and pantry.

The following are a few varieties of cheese which can be made by the average householder: Cheddar, Gouda, Cottage, Club and Cream Cheese. Of these, Cheddar lends itself least to manufacture on a small scale, as it takes from five to seven hours to complete the process and is not worth while without a minimum supply of at least eight to ten gallons of milk.

CHEDDAR CHEESE.

Equipment required:—

1. An improvised vat.
2. 2 x 5 lb. Cheddar cheese moulds.
3. Improvised knives for cutting the curd.
4. Improvised cheese press.
5. Cheese rennet.
6. Cheese colouring.
7. A dairy thermometer.
8. A supply of cheese starter.
9. A supply of hot water.

The Cheese Vat. In most households will be found a bath or basin capable of holding six to eight gallons of milk. This bath should be placed inside another bath or basin so that the space in between the two may be used for holding hot water and in this way heating the milk in the inner container. (See Fig. 1.)

Cheese Moulds. Owing to the strain imposed on cheddar cheese moulds, it is advisable to purchase this article, as the home-made variety will not prove satisfactory.

Cheese Knives. Four or five long table knives tied together will serve the purpose of cutting the curd into fairly regular size cubes. (See Fig. 2.)

Cheese Press. Cheddar cheese requires a great deal of pressure, which is difficult to get without the use of some type of lever. For this purpose a motor car jack fitted into a frame will serve the purpose admirably. (See Fig. 3.)

Cheese Rennet. Only standard brands of rennet should be used. It quickly loses its strength if exposed to light or high temperatures. It should therefore be kept in a cool, dark place. Junket powders and tablets are not satisfactory in the manufacture of cheese.

Cheese Colouring. Only standard brands of this material should be used. Cheese and butter colouring are not interchangeable, the former colouring being dissolved in water, whereas the latter is made up in liquid form by the addition of oil.

Cheese colouring is not essential in the manufacture of cheese for home use.

The purchase of a dairy thermometer and a supply of hot water completes the equipment necessary.

Milk for Cheese-Making Purposes. It is of the utmost importance that the milk for use in cheese-making must be fresh and produced under clean conditions. The use of milk held over from the previous milking is not recommended unless the milk has been kept cool.

Cheese Starter. The use of a good clean active starter is essential if a satisfactory quality cheese is to be made. Starter added in limited quantities checks the growth of undesirable ferments and assists in the development of the correct type of acidity during the making process.

Liquid starters for cheese-making purposes are obtainable free of charge from the Chief Dairy Officer, Department of Agriculture, Salisbury. These starters are issued once a month only. Full particulars may be obtained from the Chief Dairy Officer regarding this service, and the method recommended for the propagation from day to day of the culture.

Home-made starters are not satisfactory, and for this reason it is suggested that prospective cheese-makers should take advantage of the service offered by the Department of Agriculture.

The Making Process. Carefully strain the milk into the scalded vat through at least two thicknesses of butter muslin. Adjust the temperature of the milk in the vat to 88 degrees F. by the addition of hot or cold water in the outer jacket.

Addition of Starter. As a general rule one-half pint of starter added to each 10 gallons of milk in the vat will give satisfactory results. Strain the starter into the vat through at least two thicknesses of butter muslin. Stir the milk thoroughly for a minute or two, cover the vat with a piece of sheeting and keep the milk at a temperature of 88 degrees F. for 45 minutes.

Colouring. The addition of colouring is not essential, but if desired may be added at this stage in the proportion of one teaspoonful to 10 gallons of milk.

Addition of Rennet. When the milk has ripened for 45 minutes after the addition of the starter, the rennet may be added. This is added in the proportion of one teaspoonful of rennet to each 2½ gallons of milk in the vat.

The rennet, before addition to the milk, should be diluted with 8-10 times its own volume of cold water. Stir in the rennet for two or three minutes. Cover the vat for 45 minutes. At the

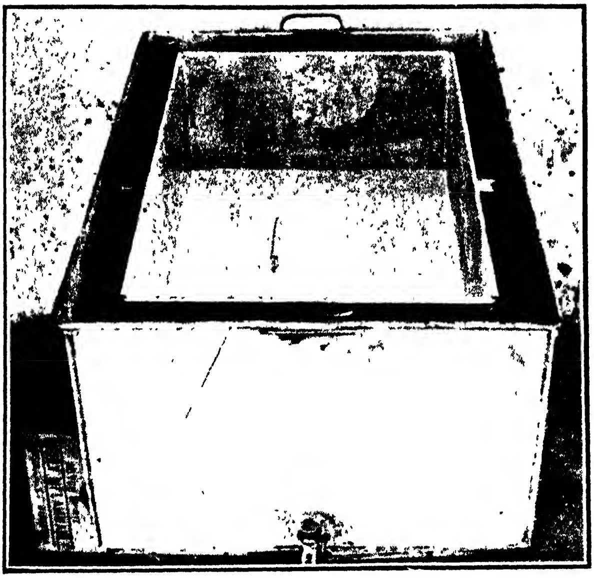

Fig. 1—The milk in the vat. Any vessel or bath can be used.

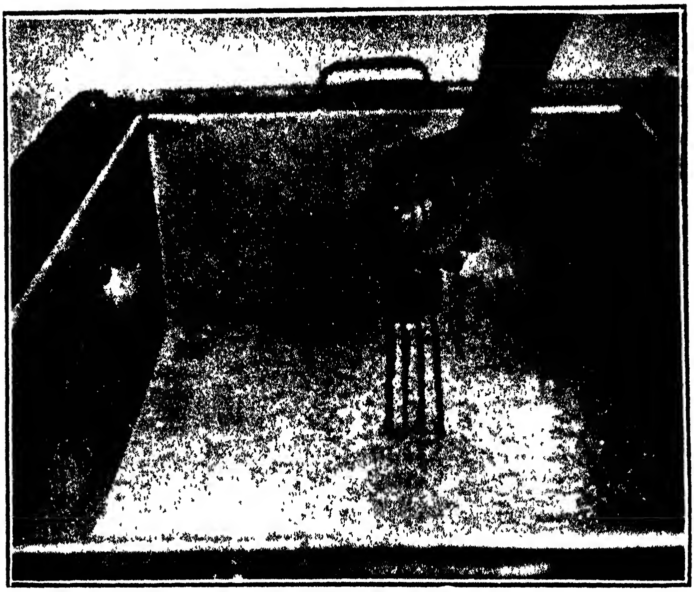

Fig. 2.—Cutting the curd with table knives tied together.

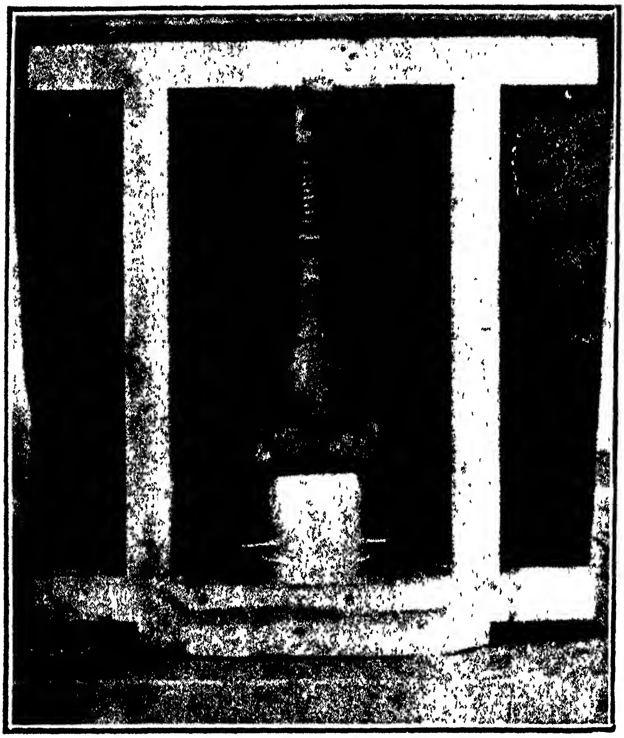

Fig. 3.—An effective cheese press made with the help of a wagon jack.

Fig. 4.—Filling the mould.
The curd is pressed in the mould with the flat hands until it is ¾ to 1 inch above the rim.

end of this time the milk will have coagulated and be ready for cutting.

Cutting the Curd. Place the improvised knives in the vat in a vertical position and cut the curd lengthwise and then crosswise; gently stir the curd from the bottom and continue the cutting until the pieces are of a fairly even size, roughly ¼-inch cubes. (See Fig. 2.)

Heating the Curd. When the cutting is completed the curd should be gently stirred by hand for five minutes. The temperature of the curd is then gradually increased to 100 degrees F. by the addition of warm water in the outer jacket or container. One hour should be occupied in raising the temperature to 100 degrees F. and of this time 30 minutes devoted to increasing the temperature to 90-92 degrees F. During this period the curd should be stirred continuously.

The curd should be kept in the whey for a further 1-1½ hours, during which time the curd may be allowed to settle on the bottom of the vat for 15-minute intervals, and stirring resumed for 15 minutes. It is of the utmost importance that during the whole of this period the curd must not be allowed to drop below 100 degrees F. The temperature should be checked every 10-15 minutes and hot water added to the outer jacket when necessary.

Drawing-off the Whey. After the curd has been on the whey for 2-2½ hours from the time of cutting the curd, the whey may be removed. Allow the curd to settle on the bottom of the vat for a few minutes and then scoop off the surface whey with a jug or basin. Tilt the vat slightly, and complete the withdrawal of the whey by straining through a sieve.

Cheddaring the Curd. When all the whey has been drawn off, tie the curd in a piece of sheeting, and keep warm on the bottom of the vat. Open the cloth every 20 minutes and cut the curd into approximately 4-inch squares and re-tie. The cheddaring process may be assisted by the addition of weights to the curd at the end of 40 minutes. This merely consists of placing a weight of about 10-15 lbs. per pound of curd, or for convenience per 10 gallons of milk originally in the vat, on the curd.

The cheddaring process should take about two hours, if a cheese with a good body is aimed at, and is complete when the curd can be torn apart like the breast meat of a chicken.

Milling the Curd. When the cheddaring process is completed the curd is removed from the cloth and cut into cubes of about ½ inch.

The curd must be stirred and aerated occasionally to reduce the temperature to 80-85 degrees F. At least 30 minutes should be occupied in cutting the curd and reducing the temperature to 80-85 degrees F. before the salt is added.

Salting. Finely-ground dairy or table salt is now added to the curd in the proportion of 1 oz. to every three gallons of milk originally in the vat. It should be spread evenly over the curd, and the curd thoroughly stirred to obtain even distribution. The curd should then be piled in one corner of the vat for 30 minutes to allow the salt to dissolve. Cover the vat at this stage to avoid bleaching of the curd.

Moulding the Curd. The mould should be assembled by fitting the flexible steel lining into the smaller of the two lids and lining the interior with tubular cheese bandage—a portion of which (about 2 ins.) is allowed to overlap the flexible lining. The collar or outer portion is then placed in position, the two hooks preventing it sinking to the level of the bottom lid. (Suitable cheese bandage may be run up on a sewing machine, using butter muslin or thin calico.) The mould is now gradually filled with curd, taking care to press the curd in well with the clenched fists. When filled, the top lid is placed on the mould, the hooks removed and the mould placed in the press.

Pressing. No accurate means of gauging the pressure applied is possible when using the motor jack as recommended. As a rough guide, however, a 5-lb. or 10-lb. cheese requires anything up to 1,500 lbs. pressure. This should be some indication of the amount of pressure to exert on the jack. Pressure should be applied gradually, the maximum being reached in about 45 minutes. Pressure should be maintained for at least 24 hours, and for preference 48 hours.

Dressing and Bathing the Curd. After being under pressure for 18-24 hours, the cheese should be removed from the mould, the bandage pulled up and the top and bottom portion trimmed so as to form a neat ½-inch rim around the edge of the top and bottom of the cheese. When satisfactorily trimmed, the cheese should be immersed for a minute or two in hot water at a temperature of 140 degrees F. Replace the cheese in the mould (which has in the meantime been washed) and press for a further 24 hours, if possible.

Curing the Cheese. The coolest spot in the pantry should be selected for this purpose. The cheese should be kept on a plate to catch any fat which may escape, and turned every day.

The curing process should be complete in about six weeks, when the cheese should be ready for consumption.

GOUDA OR SWEET-MILK CHEESE.

Gouda or sweet-milk cheese, as the name implies, is made from perfectly sweet milk. It is fairly quick maturing, being ready for consumption three to four weeks after manufacture, and is comparatively easy to make. Most of the equipment required can be improvised in the home. It consists of:—

1. Improvised cheese vat.
2. Improvised cheese knives.
3. Improvised cheese press.
4. Improvised Gouda cheese moulds.
5. Cheese colouring (not essential).
6. Cheese rennet.
7. Calico for bandages.
8. Dairy thermometer.
9. Cheese starter.
10. Salt.
11. A supply of hot water.

The Vat, Knives and Press. These can quite easily be improvised in the home, as described under the heading "Cheddar Cheese."

Gouda Moulds. It is advisable to purchase standard gouda cheese moulds (see Fig. 4), but these may be improvised by using suitably large tins, such as Glaxo or Lactogen baby-food tins; they should be sufficiently large, so as to hold about 5 lbs. of curd. The ridge around the top of the tin should be trimmed off smoothly with the side, so that the lid will slip easily into the tin.

The bottom and sides should be punctured from the inside with a fairly thick nail to permit the escape of whey. Half a dozen holes in the bottom and about a dozen holes fairly evenly spaced in the sides will prove satisfactory.

The Making Process. Strain the milk through at least two thicknesses of butter muslin into the scalded vat or receptacle and adjust the temperature of the milk to 88 degrees F. by the addition of hot or cold water to the outer jacket.

Starter. This should be used as described in the making of cheddar cheese.

Cutting the Curd. The curd should be ready for cutting in 35-45 minutes. Insert the improvised knives vertically at one end of the vat and cut the curd lengthwise and then crosswise. Gently stir the curd by hand from the bottom upwards and continue cutting until the particles of curd are about the size of wheat kernels.

Heating the Curd. Immediately after cutting, the curd should be allowed to settle to the bottom of the vat for five minutes. One-quarter of the whey is then removed and is replaced with an equal quantity of water at 140 degrees F., the latter being added in small amounts at a time over a period of 30 minutes, the idea being to raise the temperature of the curd to 102 degrees F.

The heating process should not take longer than 30 minutes, and during this period the curd should be gently stirred by hand. If at the end of 30 minutes the desired temperature has not been reached, hot water should be added to the outer jacket of the vat so as to bring the temperature up to 102 degrees F. The hot water used to replace the whey should for obvious reasons be pure and wholesome.

Drawing-off the Whey and Salting. When the desired temperature has been reached the curd should be allowed to settle on the bottom of the vat and the whey removed, leaving only just sufficient to keep the curd particles from sticking together and forming a solid mass. At this stage salt is added at the rate of ½ lb. of salt to each 10 gallons of milk. Sprinkle the salt evenly over the curd, stir in for 3-4 minutes to obtain even distribution. Cover the vat for 15 minutes in order that the salt may be absorbed by the curd.

Weighting the Curd. At the end of 15 minutes the remaining whey should be removed and the curd tied loosely in a cloth. The curd is now pressed by applying weights in amounts not ex-

ceeding 2 lbs. per lb. of curd, or for convenience a 2-lb. weight per gallon of milk originally in the vat. After pressing in this manner for 30 minutes the curd is ready for moulding.

Moulding the Curd. The curd is now removed from the cloth and cut into blocks of a rough size to fit the previously scalded mould. Any odd pieces of curd may be placed in the mould and pressed down well by hand. The curd is turned in the mould several times in order to shape. After shaping in this manner for five minutes or so, the curd is removed from the mould, the mould dipped in hot water and lined with a warm calico cloth and the curd replaced in an inverted position. The cloth is folded so as to cover the curd, the lid placed in position and the cheese subjected to light pressure for 10 minutes and the pressure gradually increased until the maximum amount of 10 lbs. per lb. of cheese is obtained at the end of 30 minutes. (See Fig. 4.)

Removal of Cheese from Mould. At the end of 24 hours the cheese should be removed from the mould, lightly rubbed over with salt and placed in a cool place for ripening. Turn the cheese daily for the first week and thereafter at least twice each week.

Gouda cheese must at all stages during the ripening process be protected from draughts, which are liable to cause cracks in the rind.

DEVONSHIRE CREAM.

Devonshire cream is comparatively easy to make; it is a thick cream, rich in food value and can be made without the need for any purchased equipment. Milk for this purpose should be produced under the best conditions possible and should be strained through a double thickness of butter muslin into the widest saucepan to be found in the kitchen. The saucepan should not be filled over 8 ins. from the bottom.

Cool the milk as rapidly as possible by standing the saucepan in a basin of water, changing the water several times during the first hour or two.

Cover the saucepan with a muslin cloth and allow the milk to stand for 12 hours undisturbed in the coolest spot in the pantry for the cream to rise to the surface.

During the winter months the period of settling may be extended to 24 hours, but for all practical purposes 12 hours should not be exceeded during the summer months.

At the end of this period the milk is gradually brought up to a temperature of 175 degrees F. by either placing directly on the stove or by standing the saucepan in a larger vessel containing water, which is then heated on the stove.

The heating should under no circumstances take less than 30 minutes to accomplish, during which time the milk should not be stirred. If a pronounced cooked or caramelised flavour is desired, the milk should be heated directly on the stove and not in water.

At the conclusion of the heating or shortly afterwards the cream on the surface of the milk will become wrinkled. Take the saucepan off the stove and cool down the contents as rapidly as possible by standing the saucepan in running cold water.

When cool, skim off the cream on the surface with an egg-lifter. Under summer conditions the cream will keep fresh for three or four days when kept at low temperatures in the "fridge."

CLUB CHEESE.

Club cheese is a very appetising dish and may be prepared from any stale cheese found on the pantry shelf mixed with six to eight times its own weight of butter. It has poor keeping qualities and should therefore be consumed within a day or two.

Preparation. Remove and discard the rind from the cheese to be prepared. Cut up the cheese into small pieces, weigh, run through a meat-mincing machine. Weigh-off the correct amount of butter and cut it into small pieces and roughly mix the cheese and butter, then once again put through the mincing machine. A pinch of pepper well worked in will add considerably to the flavour.

COTTAGE CHEESE.

Place the fresh skim-milk in a basin or enamel pail and cool to 70-75 degrees F. Add about a pint of starter to every gallon of skim-milk and stir thoroughly for five minutes. Cover the milk with a muslin cloth and allow to coagulate.

Coagulation should occur from 6-12 hours from the time the starter has been added. It would therefore be advisable to add the starter at night and manufacture the cheese the following morning.

When the milk has set, it should be cut into small pieces, about ½-inch cubes, or merely broken by stirring.

Heat the curd gradually to 98 degrees F. by immersing the pail in hot water; this should take about 20 minutes, after which the curd should be held at this temperature for a further 15 to 20 minutes (the entire heating process), during which the curd should be stirred continuously, thus taking about 35 to 40 minutes.

The curd and whey is then poured on to a draining cloth spread over a draining rack, care being taken to break the curd as little as possible during the process; the ends of the cloth are then tied to form a bag, which is hung up to drain; the bag is opened occasionally and the curd scraped with a knife from the sides to the centre of the cloth. Drainage is continued until very little whey is seen escaping through the cloth; at this stage the curd should be fairly dry but not crumbly.

The curd is then minced or mashed with a spoon or fork until it is smooth and more or less of the consistency of mashed potatoes; salt is then worked in according to taste.

This cheese has poor keeping qualities and should be consumed when fresh.

Control of Harvester Termites

By M. C. MOSSOP, M.Sc., Chief Entomologist, Department of Agriculture.

In the climatically drier parts of the Colony, and more widely distributed during years of drought, damage by harvester termites (*Hodotermes* and *Microhodotermes*, spp.) is far more noticeable than in moister climes or moister times. But even in normal times the pest can influence both the number of head of livestock which can safely be grazed over a given area, and the amount of wheat, oats, lucerne, etc., that can be reaped.

The Habits and Economy of Harvesters. Harvester termites at work can be recognised by their habit of dragging or carrying over the ground, to the tunnels leading to their subterranean nests, short lengths of grass or twigs which they have cut or collected. They may be seen doing this work in broad daylight, unprotected by any sheltering earthen runways constructed on the surface by other termites. Cold air, biting wind, or blazing sun will tend to keep the insects underground. The queen, though not of the well-known repulsive, large, flabby type confined to a cell, is nevertheless larger than her subjects, and moves about freely within the confines of the nest. Her mobility, combined with the structure of her subterranean residence, makes it quite impracticable to seek her out by digging.

Termites of the harvester type do not normally build surface mounds above their nests. The destruction of harvester termites which build such mounds, e.g., the snouted harvester termites, can be effected by mound demolition and fragmentation, combined with gassing, as their nests are easily located. But not so the non-mound-inhabiting harvester termite, which leaves no useful surface indication of the site of its nest. In the present article it is this termite that is referred to simply as the harvester termite.

Instead of building mounds with the soil which is excavated in the construction of nests and tunnels, these harvesters deposit the soil on the surface in small heaps of loose particles. The heaps may be widespread and bear little recognisable relation to the site of the nest. They are dumps rather than planned mounds, except that they include at least a central vertical tunnel to the open, through which the harvesters have egress from their underground passageways for depositing unwanted soil particles. The larger of these dumps may have more than one peak. The dumps seldom grow very large, as they easily erode.

Apart from denudation, then, the most easily recognisable sign of the presence of harvesters lies in the irregularly spaced dumps. In the same area, however, are numerous harvesting holes used

by the foraging workers. The entrances to these may be pluggegd up with soil when not in use, but they may be readily found when the earthen plugs are removed and the workers are busy in the vicinity. Sometimes circles of harvested grass are left around the plugged-up holes and help to draw attention to them. As the sites of the harvesting holes are governed by the surface distribution of supplies which go to make the harvest, these positions are even less useful than those of the earth dumps as indicators of the site of the nest.

The grass collected by harvesters is taken underground and stored there for use. When sources on the surface and supplies in storage are plentiful, surface activity is intermittent, as replacements are secured with a minimum of labour. But during times of scarcity of grass brought about by the time of year, lost fertility, drought, overstocking or soil erosion, activity may be about as frequently observable as the weather permits. This is because the insects have to dissipate their labour by tunnelling ever further afield, and under these conditions a colony harvests less in a day and the harvesters are consequently seen working on more days. Under these conditions, also, their depredations are more noticeable. The impression is gained that the population of the Colony has increased, but this is not necessarily so. What has increased is the opportunity for observing the damage.

Control. As it has been suggested that more intensive farming and settlement tend to eliminate some of the important vertebrate enemies of termites, it becomes more necessary to recognise harvesters during periods of plenty in order that their inroads on our grazing and veld cover in times of need may be reduced to a minimum. Evidence has been produced in the Union of South Africa that conditions which can be brought about by overstocking, drought, soil erosion, etc., can favour the establishment of harvester colonies. It follows, then, that the first and fundamental guiding principle must be that land must not be allowed to get into the condition which can be brought about by these undesirable pre-requisites. Of primary importance is the conservation of water, soil, cover, and fertility. This includes the prevention of over-grazing and the observance of good veld and pasture management. Whether the land concerned consists of worn-out farms, or tracts of newly opened veld, especially in less humid parts, neglect to observe this fundamental principle is asking for trouble. Good farming pays.

Where it is necessary to reduce existing populations and exterminate colonies of harvesters, the poison bait method can be used with success. It should be used as a first step in the reclamation of land denuded by these insects. It must, however, be followed by or combined with planned conservation methods.

The fact that harvesters collect food for consumption by the community underground makes it possible for us to induce them to stock with poisoned food the so-called granaries (which might be better termed "graminaries") upon which the whole colony feeds. The fact that they are not repelled by the cheapest of our more deadly poisons, sodium arsenite, makes the method economical and the destruction complete.

The Poison Bait. The bait is prepared by soaking dry grass, cut to lengths not exceeding half an inch, in water containing one pound weight of sodium arsenite to every eight gallons, and then thoroughly drying it. Facilities for the preparation of bait include a fenced-in working space enclosing a chaff-cutter, a stack of dry grass or hay, water, poison, and the means of measuring its weight, one or more 44-gallon drums, a plunger to serve in the submerged baskets as a piston for pressing down the grass (consisting of a wooden disc with a suitable long handle attached to its centre at right angles), rakes or pitchforks, one or more bucksails on which to dry the bait, specially marked bags or covered baskets or other covered receptacles in which to receive, store and transport the dried bait, and grease for protecting exposed skin from the caustic and subsequent poisonous action of the sodium arsenite, especially on the hands and around the finger nails.

The method of procedure with the above equipment is practically obvious, but it should be explained that the cut grass should be submerged in the baskets by means of the plunger, which will also expel air and expedite wetting. When the grass is judged to have become wet, the basket is raised above the liquid and left for a while to drain, after which the contents are spread on to a tarpaulin to dry. Drying is facilitated by frequent turning with a rake or fork. The bait thus made must be thoroughly dried before being stored, and will keep more or less indefinitely in that condition.

Every precaution should be taken during preparation, storage and use of bait against poisoning of humans, livestock and game animals. Some hints in this respect were given in various locust control circulars issued during the past Red Locust campaign. For instance, reprints are available on application to the Chief Entomologist of a short article, "Locust Poison, Directions for Use, 1934-35 Campaign," originally published in the "Rhodesia Agricultural Journal" in December, 1934.

The best time to apply the bait on grazing lands is towards mid-winter, which is about the earliest that the harvesters are readily seen to be regularly at work. The preparation of the bait, therefore, is best carried out in the late summer or early autumn when there is plenty of grass available and no last-minute haste. When baiting is required in cultivated lands, the bait is best applied before sowing, although the advantage of identifying sites may become apparent if baiting is left until shortly after the grain has sprouted.

One application of bait spread evenly over the veld at the rate of two bags per acre (about 6½ bushels per acre) has been shown to be sufficient. Visible harvester activity should cease after a couple of months. A larger quantity of bait is unnecessary and is likely to result in an undesirable excess being left for livestock. The cost of baiting should not be more than about 8d. or 9d. per acre, but the inclusion of dead animals, though affording improved grazing facilities for their more fortunate colleagues, and possibly solving the overstocking problem, might send up the cost of control out of all proportion. For similar reasons, and also to obtain the best efficiency from the distribution of poison baits, the half-inch length for grass bait should not be exceeded,

and the bait should be perfectly dry so that it can be thinly and evenly dispersed. For the more complete safety of stock, it should be made a rule that veld or pasture baited during the winter should not be used for grazing until good, soaking rains have fallen. In some circumstances this may cause a severe strain on the pasture management programme, and it calls for careful anticipatory planning and the avoidance of treating too many pastures in any one dry season.

Where it is essential to use treated land before the poison bait has been well soaked by rain, a certain amount of risk may be taken if all precautions to ensure even and light distribution have been faithfully observed, and if it has been noticed that harvesters have been doing their part in removing the bait. It was shown in 1934 by field experiments carried out by the Division of Chemistry that there is "a progressive decrease from month to month in the arsenic content of grass sprayed with sodium arsenite solutions, irrespective of rainfall." To what extent such a decrease would be present or effective in exposed poison bait is not known, but in general it can be accepted that for various reasons, under practical conditions of baiting, the danger would be expected to decrease somewhat with the passage of time. A further safeguard would be to substitute sodium fluosilicate for the sodium arsenite, but the mixture should be constantly stirred during soaking, as the sodium fluosilicate will not all dissolve. Sodium fluosilicate is not safe, but used in this way it is much less dangerous than sodium arsenite.

Summary. Harvester termites can be recognised by their habit of carrying over the ground, while unprotected by any earthen shelters, short lengths of grass to the tunnels leading to their underground nests. These activities can lower the carrying capacity of the veld and lead to soil erosion and veld denudation. Their threat should be countered by careful avoidance of overstocking and the observance of a sound policy of pasture management and conservation of soil, water, cover and fertility. If more artificial and drastic methods should become necessary, colonies can be eliminated by one winter application of two bags (about 6½ bushels) of dry bait per acre, spread evenly and without lumps on the ground. The poison bait is made by soaking dry grass up to half an inch in length in a solution of 1 lb. of sodium arsenite in 8 gallons of water and drying the bait, which can be stored in this condition. Except in special circumstances, animals should not be grazed on treated land until soaking rains have fallen. For best results, baiting should be considered as no more than an aid to good conservation methods.

Acknowledgments. The writer of this compilation is deeply indebted to Mr. W. G. H. Coaton, of the Division of Entomology, Pretoria, for very generously supplying, before publication, a manuscript of his excellent paper, "The Harvester Termite Problem in South Africa," which unifies previous work on the subject with many original observations based on his own experimental work.

The following papers have been consulted:—

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HUSBAND, A. D., and DUGUID, J. F. 1934. The Toxicity of grazing Animals to Grass Sprayed with a Solution of Sodium Arsenite. Rhod. Agric. Journ., Vol. XXXI, No. 1, pp. 25-39.

Seasonal Growth and Changes in Chemical Composition of the Herbage on Marandellas Sandveld

By H. WEINMANN, Dr.Agric., D.Sc., Pasture Research Chemist.

The investigation of methods of utilisation and management of natural veld is one of the main points in the new Pasture Research programme. Of fundamental importance for any further research is a knowledge of the productivity of the veld, and of the quality and feeding value of the more important grasses and associated plants. This paper reports the results of certain investigations carried out during the 1946-47 season at the Marandellas Grassland Experiment Station. Yield cuts were taken on a typical granite sandveld pasture at six different stages of growth, and the changes in the chemical composition of the grasses and associated plants were investigated.

METHODS.

The area had been stumped in the 1929-30 season; during 1930 to 1932 it was repeatedly cut and grazed, and rock phosphate was applied. In the following years, however, only little use was made of the paddock, and it remained protected from 1940 onwards. The vegetation is the typical association of grasses and leguminous herbs (mainly *Eriosema englerianum*, commonly known as Vaalbos, and *Dolichos lupiniflorus*). Ten of the most important species of grasses are listed below.* There is a certain amount of coppice growth of *Brachystegia randii* (Msasa) and of *Isoberlinia Globiflora* (Mnondo). Other species of frequent occurrence are:—*Anona senegalensis* (wild custard apple), *Aspilia* sp., *Berkheya zeyheri*, *Clematopsis stanleyi*, *Eupatorium africanum*, *Indigofera* sp., *Lannea edulis*, *Pretrea zanguebarica*, *Protea* spp., *Senecio* spp., *Sesbania* sp., and various sedges, such as *Cyperus* spp. and *Fimbristylis exilis*.

The soil of the area is an acid sand of granitic origin, poor in organic matter, nitrogen and available mineral nutrients. The results of a mechanical and chemical analysis of the soil (to a depth of 9 ins.) are given in Table I.

*See Section "Seasonal Chemical Changes in Individual Species of Grasses."

TABLE I.

Composition of Marandellas Sandveld Soil.

(Constituents as percentages of the dry fine soil.*)

Coarse Sand	66.9	CaO	0.07
Fine Sand	19.8	MgO	Trace
Silt	3.0	K_2O	0.02
Clay	9.0	P_2O_5	0.02
Loss on Ignition	2.75	Available K_2O	0.004
Carbon	0.46	Available P_2O_5	0.002
Nitrogen	0.05	pH	6.5

The rainfall at Marandellas during the 1946-47 season amounted to 25.10 inches. While this is considerably less than the normal rainfall (35 to 40 inches), it is not considered that this affected the results of the present work to such an extent as to render them atypical.

Twenty-four quadrats, each 2 x 2 yds. in size, were laid out in the described area in the winter of 1946. All old herbage in these quadrats was cut down and removed at the end of winter. During the season 1946-47 cuts were taken at monthly intervals, four different quadrats (randomised over the whole experimental area) being harvested on the 10th of every month from December, 1946, to May, 1947. That is, every quadrat was cut only once during the season, and the herbage yields and figures for the chemical composition given below represent yields and quality of the herbage at six different stages of growth. Cutting was done with sheep-shears, the herbage being removed as completely as possible. The herbage of grasses and all other plants was harvested separately in each case. The individual herbage samples were air-dried and weighed; for the chemical analysis the four samples harvested on the same day were combined (grasses and other plants separately).

RESULTS.

Dry Matter Yields. Table II and Fig. 1 show the yields of grasses and other plants in pounds dry matter per acre.

*The figures (except the one for the carbon content) are the results of earlier analyses carried out by the Chemistry Branch, and are reproduced here by courtesy of the Chief Chemist.

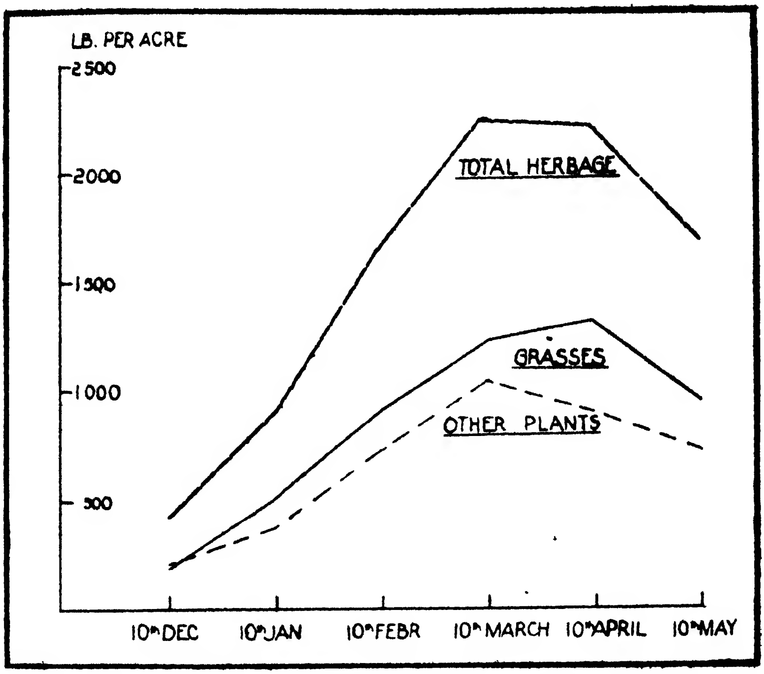

Fig. 1.—Herbage Yields at Different Stages of Growth (in pounds dry matter per acre).

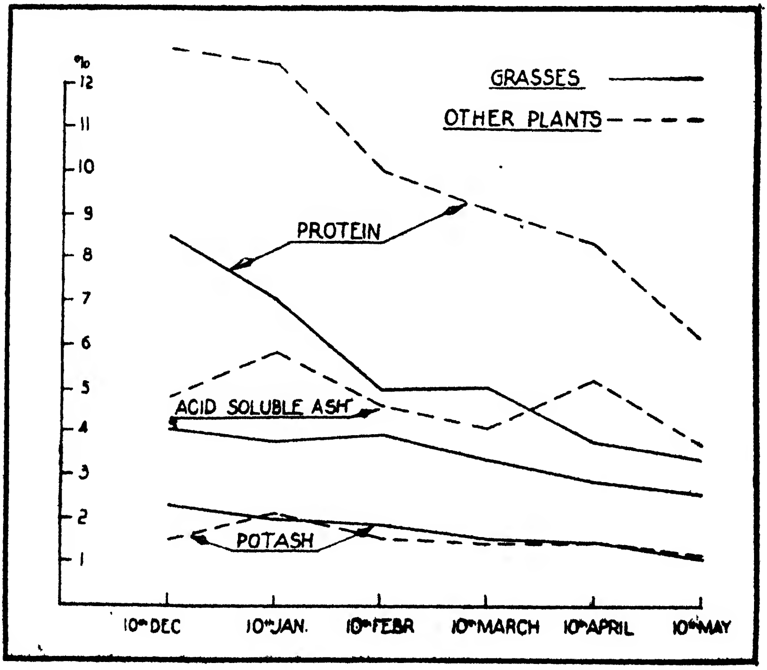

Fig. 2.—Protein, Acid-soluble Ash, and Potash Content at Different Stages of Growth.

TABLE II.

Herbage Yields on Marandellas Sandveld at Different Stages of Growth.

(In pounds dry matter per acre.)

Date.	10/12/46	10/1/47	10/2/47	10/3/47	10/4/47	10/5/47
Grasses	204	510	908	1,214	1,305	940
Other Plants ...	215	383	724	1,040	889	714
Total Herbage	419	893	1,632	2,254	2,194	1,654

As would be expected, yields increased with the advance of the season; the maximum yield was obtained for the grasses on 10th April, while the highest yield of other plants and also of total herbage was reached in the beginning of March. The decreases towards the end of the season are, naturally, due to the dying-off of the plants with the approach of winter. The proportion of non-grasses ranged from 40.6 to 51.4 per cent. of the total herbage yields, with an average of 47.2 per cent. It should be pointed out that under practical conditions considerably lower yields (in lbs. per acre) would have to be expected on account of unevenness, bare patches, and the less efficient methods of cutting. Also, the fact that the paddock in which these cuts were taken had been rested for a number of years may have contributed to the relatively high yields in the present case. Previously recorded figures for hay yields on sandveld of this type have, in fact, been considerably below those attained in the present instance (8).

Chemical Composition of the Herbage. The results of the chemical analysis are indicated in Table III and Figs. 2 and 3.

TABLE III.

Chemical Composition of Herbage at Different Stages of Growth.

(Constituents as percentages of the dry matter.)

Date.	10/12/46	10/1/47	10/2/47	10/3/47	10/4/47	10/5/47
			Grasses.			
Crude Protein	8.52	7.09	4.95	5.05	4.05	3.39
Ether Extract	1.21	1.10	1.20	1.10	1.07	0.96
Crude Fibre	33.3	35.2	38.4	37.4	39.5	38.4
Carbohydrates	51.1	50.0	49.5	50.2	50.0	51.5
Total Ash	5.90	6.61	5.98	6.25	5.37	5.71
Acid-soluble Ash	4.03	3.76	3.87	3.35	2.85	2.57
Phosphoric Oxide	0.30	0.33	0.31	0.25	0.26	0.19
Potash	2.28	2.01	1.79	1.49	1.44	1.05
Lime	0.39	0.34	0.33	0.35	0.40	0.43

Date.	10/12/46	10/1/47	10/2/47	10/3/47	10/4/47	10/5/47
			Other Plants.			
Crude Protein	12.69	12.44	9.98	9.10	8.28	6.15
Ether Extract	1.44	1.43	1.29	1.82	2.14	2.00
Crude Fibre	31.3	31.4	35.9	40.5	34:0	41.3
Carbohydrates	49.4	48.0	47.6	43.8	48.5	46.1
Total Ash	5.16	6.73	5.22	4.79	6.67	4.46
Acid-soluble Ash	4.80	5.79	4.61	4.09	5.15	3.65
Phosphoric Oxide	0.49	0.43	0.35	0.29	0.26	0.21
Potash	1.55	2.13	1.52	1.43	1.45	1.15
Lime	1.14	1.19	1.29	0.94	1.37	1.11

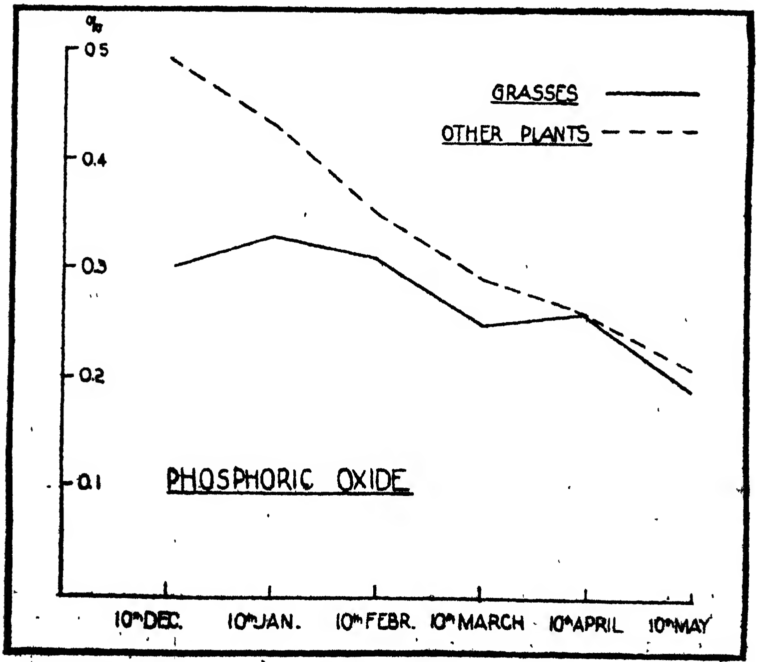

Fig. 3.—Phosphoric Oxide Content at Different Stages of Growth.

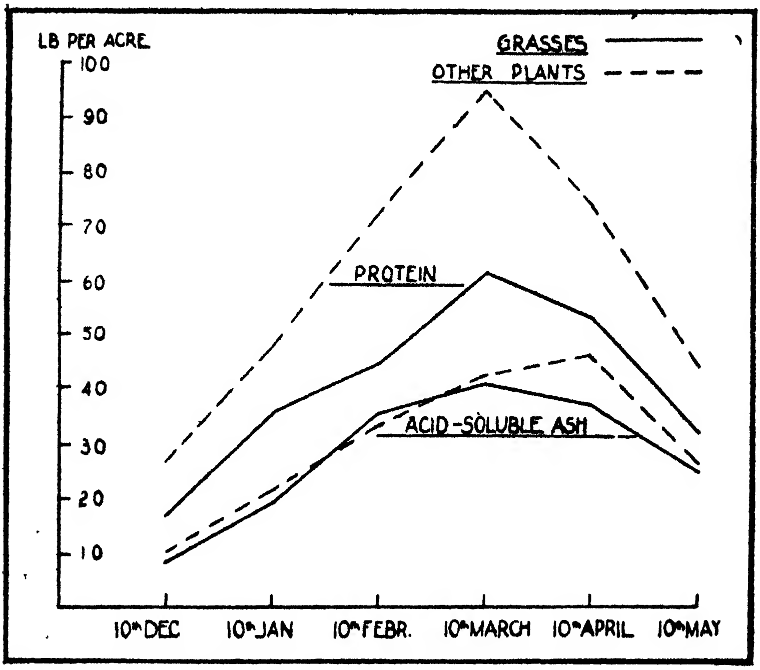

Fig. 4.—Yields of Protein and Acid-soluble Ash in Pounds per Acre.

As will be seen, there were pronounced seasonal changes in the chemical composition of the herbage. In grasses as well as in other plants the percentage of protein decreased distinctly with the advancing season. By the beginning of May the protein content had dropped to 40 per cent. of the December value in the grasses, and to 48.5 per cent. in the other plants. The crude fibre content, though showing some irregular fluctuations, increased with maturation; and while differences were not as pronounced as might be expected, it may be mentioned that workers in other countries have shown that the indigestible portion of crude fibre increases with the age of the plants. The ether extract (fats) fluctuated only slightly in the grasses, but increased in the other plants towards the end of the season. Carbohydrate (nitrogen-free extract) percentages, too, did not vary greatly.

The figures for total ash are of no particular significance, since they include silica (which is of no importance from the animal nutrition point of view), and probably even small amounts of adhering sand. The percentages of acid-soluble ash, on the other hand, represent a good index of the total available mineral material. In the grasses, the figures for acid-soluble ash show a steady decline throughout the season, but the decline was less pronounced and somewhat irregular in the other plants. Some of the increases may have been caused by a flush of young growth, following rainfall, or may be merely due to sampling errors. In both groups of plants the percentages of phosphorus and potash decreased steadily with the advance of the season, the May values being 40 to 50 per cent. lower than the December values. The percentage of lime, on the other hand, showed only minor fluctua-

Photo 1.—Typical Marandellas Sandveld Pasture. The grasses have been well grazed down: the ungrazed herbage largely consists of the bushy species of wild legumes referred to in this report

Photo 2.—Illustrating the method of taking the herbage samples.

tions, and in the grasses, at least, tended to increase towards the end of the season. It has been pointed out in a previous article (9) that the decreases in nitrogen and mineral elements in maturing herbage are partly due to remigration of these elements to the roots in autumn. Calcium does not seem to be re-translocated to the same extent as the other mineral elements, since it is apparently deposited in an immobile form in the tissue, where it may even increase with maturation (3, 4, 7). In general, the results obtained here confirm those of previous workers in this Colony (5), in the Union of South Africa (1, 2), and elsewhere.

Regarding the differences in chemical composition between grasses and other plants, it may be stated that the latter were in all stages of growth richer in protein and lime, and in the beginning of the season also in phosphorus. These differences are essentially due to the fact that the group of "other plants" includes a large proportion of wild legumes (such as Vaalbos, Dolichos species and others) which are richer in those constituents than grasses.

Nutrient Yields. Table IV gives the actual amounts of protein and mineral elements yielded at the different cutting dates, expressed in pounds per acre.

TABLE IV.

Nutrient Yields at Different Stages of Growth.
(In pounds per acre.)

Date.	10/12/46	10/1/47	10/2/47	10/3/47	10/4/47	10/5/47
		Grasses.				
Crude Protein	17.4	36.0	45.0	**61.4**	52.7	31.9
Acid-soluble Ash	8.2	19.2	35.2	**40.6**	37.2	24.2
Phosphoric Oxide	0.6	1.7	2.8	3.0	**3.4**	1.8
Potash	4.7	10.2	16.3	18.1	**18.8**	9.9
Lime	0.8	1.7	3.0	4.3	**5.2**	4.0
		Other Plants.				
Crude Protein	27.3	47.6	72.2	**94.5**	73.6	43.9
Acid-soluble Ash	10.3	21.6	33.4	42.5	**45.8**	26.1
Phosphoric Oxide	1.1	1.6	2.5	**3.0**	2.3	1.5
Potash	3.3	8.2	11.0	**14.9**	12.9	8.2
Lime	2.5	4.6	9.4	9.8	**12.2**	7.9
		Total Herbage.				
Crude Protein	44.7	83.6	117.2	**155.9**	126.3	75.8
Acid-soluble Ash	18.5	40.8	68.6	**83.1**	83.0	50.3
Phosphoric Oxide	1.7	3.3	5.3	**6.0**	5.7	3.3
Potash	8.0	18.4	27.3	**33.0**	31.7	18.1
Lime	3.3	6.3	12.4	14.1	**17.4**	11.9

The figures show that, in spite of the progressive decline of the nutritive value of the herbage throughout the season, there was an increase in nutrient yields up to March, and in some cases up to the beginning of April (see also Fig. 4). As far as the total herbage is concerned, maximum yields of protein, acid-soluble ash, phosphorus and potash were obtained with the cut of 10th March, 1947, while the yield of lime was highest in April. Total losses between 10th March and 10th May amounted to over 50 per cent. in protein, to 45 per cent. in phosphorus and potash, and to 15 per cent. in lime. This would indicate that, as far as weather conditions permit, veld should be cut for hay-making in February or early March. At that time of the year the yields of nutrients per unit area are highest. Cutting at a later date, and particularly after the onset of the dry season, is unavoidably connected with appreciable losses in valuable feeding constituents, and such hay is of a low palatability and digestibility.

A comparison of the nutrient yields of grasses and other plants is of interest. By far the greater portion of the total yields of protein and lime was contributed by the non-grasses. In the sample harvested on 10th March, 1947, approximately 61 per cent. of the total protein yield and 70 per cent. of the total yield in lime were contained in the herbage of plants other than grasses. Differences in total phosphorus between the two groups were variable, and the grasses were superior in total potash throughout the season. The superiority in protein and lime of the non-grasses is due to the above-mentioned fact that this group includes a large proportion of legumes, which are, generally, characterised by a high protein and lime content. Unfortunately, most of these plants are only of low palatibility, though they are eaten by cattle to some extent when very young and also in the form of hay and silage. While there seems little doubt that these plants by competition adversely affect the growth of grasses, it appears to be at least doubtful whether they should be classified as useless weeds. Like other leguminous plants, these indigenous legumes obtain probably a good deal of their nitrogen from the air with the help of symbiotic bacteria, which fact accounts for their relatively high protein content. As is the case with cultivated legumes, the nitrogen fixed by the plants may find its way into the soil either after the death of the plant or even during its lifetime by excretion from the roots. It is possible that the wild legumes in such a way help to maintain the fertility of the soil. There is, however, no evidence available at the present time to substantiate this statement, and further research is required to assess the true value of these plants.

Seasonal Chemical Changes in Individual Species of Grasses. In addition to the work described above, herbage samples of ten of the most important species of grasses were taken in the same area during the months of December, 1946, to June, 1947, i.e., on the 10th day of each of these months. The following species of grasses were investigated:—*Brachiaria brizantha* (upright false Paspalum), *Cynodon dactylon* (couch grass), *Digitaria brazzae*, *Digitaria milanjiana* (Milanje grass)*, *Eragrostis chalcantha*, *Heteropogon contortus* (spear, or assegai grass), *Hyparrhenia ruprechtii* (thatching grass), *Rhynchelytrum repens* (Natal red

top grass), *Sporobolus pyramidalis* (rat-tail grass*), and *Trachypogon plumosus*.* When being sampled, the herbage was cut off close to the ground, but all old herbage left over from the previous season was excluded from the samples. The samples were air-dried in the same way as those from the quadrats, and were analysed for protein and mineral elements. The results are shown in Table V.

The seasonal changes were essentially the same as those for the composite herbage samples. Except for some minor fluctuations in individual species, the percentages of protein, phosphoric oxide and potash decreased distinctly throughout the season; the general trend is particularly well shown by the monthly average figures. The lime content showed, in general, only minor fluctuations; in a number of species, at least, the percentage of lime tended to increase during the whole or part of the season (*Brachiaria brizantha*, *Digitaria brazzae*, D. *milanjiana* and *Eragrostis chalcantha*). The average figures for the lime content indicate a slight decrease during the first part of the season, followed by somewhat higher values in the second half. It is likely that previous conflicting results regarding seasonal calcium trends are largely due to the fact that individual investigators worked with different species of grasses.

TABLE V.

Seasonal Chemical Changes in Individual Species of Grasses.
(Constituents as percentages of the dry matter.)

Species.	Dec.	Jan.	Feb.	Mar.	April	May	June	Mean
				Crude Protein.				
Brachiaria br.	10.35	7.65	6.70	5.37	4.79	3.54	2.61	5.86
Cynodon d.	13.58	11.27	7.44	8.46	6.43	5.25	4.76	8.17
Digitaria br.	9.13	6.11	3.98	4.27	4.03	3.71	2.69	4.85
Digitaria m.	—	6.55	4.15	2.93	2.45	1.79	1.74	3.27
Eragrostis ch.	8.87	6.04	4.92	4.84	4.30	3.76	2.99	5.10
Heteropogon c.	7.38	5.58	4.86	3.69	3.74	3.69	2.86	4.54
Hyparrhenia r.	8.98	6.43	4.17	3.11	2.76	2.13	1.54	4.16
Rhynchelytrum r.	9.63	8.03	5.82	5.85	4.51	4.32	3.15	5.90
Sporobolus p.	—	9.74	5.48	5.22	4.51	3.43	3.19	5.26
Trachypogon pl.	—	7.74	4.77	3.52	2.51	2.36	2.06	3.83
Average	9.70	7.51	5.23	4.73	4.00	3.40	2.76	--

*Not sampled in December, 1946.

Species	Dec.	Jan.	Feb.	Mar.	April	May	June	Mean
Phosphoric Oxide.								
Brachiaria br.	.47	.40	.41	.32	.36	.20	.18	.33
Cynodon d.	.42	.45	.37	.46	.42	.19	.29	.37
Digitaria br.	.40	.42	.34	.29	.25	.26	.18	.31
Digitaria m.	—	.33	.24	.13	.12	.06	.06	.16
Eragrostis ch.	.38	.32	.37	.28	.27	.19	.13	.28
Heteropogon c.	.41	.32	.27	.27	.16	.22	.13	.25
Hyparrhenia r.	.50	.44	.31	.29	.21	.13	.21	.30
Rhynchelytrum r.	.50	.47	.41	.31	.27	.25	.25	.35
Sporobolus p.	—	.54	.37	.40	.36	.29	.24	.37
Trachypogon pl.	—	.33	.29	.20	.16	.12	.09	.20
Average	.44	.40	.34	.30	.26	.19	.18	—
Potash.								
Brachiaria br.	3.77	2.84	2.49	1.72	1.67	1.32	0.97	2.11
Cynodon d.	2.67	2.25	1.43	1.49	1.32	0.83	0.84	1.55
Digitaria br.	4.85	2.93	3.09	1.84	1.63	1.67	1.45	2.50
Digitaria m.	—	2.98	2.51	1.87	1.23	0.65	0.52	1.63
Eragrostis ch.	2.16	2.12	1.01	0.77	0.52	0.53	0.40	1.07
Heteropogon c.	2.37	2.03	1.39	1.16	1.03	0.93	0.63	1.36
Hyparrhenia r.	2.82	2.12	1.42	1.28	0.86	1.06	0.62	1.45
Rhynchelytrum r.	2.96	2.59	1.72	1.67	1.25	1.16	0.82	1.74
Sporobolus p.	—	2.63	2.11	2.38	2.28	1.99	1.76	2.19
Trachypogon pl.	—	1.94	1.45	1.18	0.92	0.81	0.60	1.15
Average	3.09	2.44	1.86	1.54	1.27	1.10	0.86	—

Species	Dec.	Jan.	Feb.	Mar.	April	May	June	Mean
				Lime.				
Brachiaria br.	.27	.31	.34	.40	.46	.45	.47	.39
Cynodon d.	.60	.47	.40	.44	.54	.36	.49	.47
Digitaria br.	.39	.23	27	.44	.50	.46	.41	.39
Digitaria m.	—	.19	.21	.28	.29	.31	.28	.26
Eragrostis ch.	.22	.24	.34	.36	.41	.39	.35	.33
Heteropogon c.	.28	.22	.25	.26	.23	.35	.27	.27
Hyparrhenia r.	.59	.39	.29	.34	.33	.29	.31	.36
Rhynchelytrum r.	.30	.20	.25	.27	.27	.29	.28	.27
Sporobolus p.	—	.27	.33	.28	.31	.32	.28	.30
Trachypogon pl.	—	.30	.22	.35	.20	.16	.18	.24
Average	.38	.28	.29	.34	.35	.34	.35	—

There are interesting differences in the chemical composition of the individual species of grasses, indicating that some of them are more valuable from the feeding point of view than others (see mean values in last column of Table V). *Cynodon dactylon* (couch grass) ranked highest amongst the ten species in protein, phosphorus and calcium content. These results may have been influenced to some extent by the fact that this species had to be sampled mainly from the neighbourhood of old ant-heaps with a soil richer than in the rest of the pasture. The results confirm, however, those of Meredith (6), who, from extensive studies in Natal and the Transvaal, concluded that couch grass is superior in phosphorus and lime content to many other indigenous South African grasses. This grass can withstand trampling and heavy grazing better than the other veld grasses, and under Transvaal Highveld conditions was found to produce up to 2½ tons of dry matter per acre when well supplied with fertilisers. Also, it was found possible to maintain a high protein content in this grass by dressings of readily available nitrogenous fertilisers. Further investigations to explore the potentialities of this grass under Rhodesian conditions have now been initiated at the Marandellas Station.

While none of the other grasses equalled *Cynodon dactylon* in the mean protein and lime content, several were as high or nearly as high in phosphorus content (*Sporobolus pyramidalis, Rhynchelytrum repens* and *Brachiaria brizantha*). The following species were particularly low in protein content: *Digitaria*

milanjiana, *Trachypogon plumosus*, *Hyparrhenia ruprechtii* and *Heteropogon contortus* (means ranging from 3.3 to 4.5 per cent. protein). Species definitely low in lime content are *Trachypogon plumosus*, *Digitaria milanjiana*, *Heteropogon contortus*, *Rhynchelytrum repens* and *Sporobolus pyramidalis*, their seasonal means ranging from 0.24 to 0.30 per cent. lime. *Digitaria milanjiana* and *Trachypogon plumosus* were also characterised by the lowest phosphorus content (means 0.16 and 0.20 per cent. phosphoric oxide resp.).

Such differences in the chemical composition of individual species of grasses, grown in the same area, are to some extent dependent on their morphological structure. Since the leaves of grasses are usually higher in protein and mineral elements than their stems, the more leafy species of grasses can, generally, be regarded as the more valuable ones. It must be pointed out, however, that apart from the chemical composition, also other characteristics, such as productivity, palatability and digestibility, have to be taken into account if the full value of a pasture grass has to be assessed.

SUMMARY.

Veld herbage was cut at monthly intervals (representing six progressive stages of growth) during the 1946/47 season at the Marandellas Grassland Experiment Station.

Dry matter yields increased up to the beginning of April for grasses, and up to March for other plants, after which time decreases in yield took place.

The percentages of protein, acid-soluble ash, phosphoric oxide and potash decreased during the season, while lime showed only minor fluctuations. Crude fibre increased with the advance of the season.

The yields of protein, acid-soluble ash, phosphorus and potash in the total herbage (in pounds per acre) increased with the advancement in growth stage, reaching maxima in the beginning of March; yields of lime were highest in the beginning of April. The grasses were inferior in protein and lime content to the other plants, and the latter group contributed the greater portion of the yield of these constituents. Considerable losses of nutrients were recorded towards the end of the season, and it is recommended to cut veld for hay-making, if possible, not later than in early March.

Results of chemical analyses on ten individual species of grasses showed the same seasonal trends as were obtained for the composite herbage samples, though the individual species were found to differ in their chemical composition. Amongst the species of grasses investigated, *Cynodon dactylon* (couch grass) ranked highest as regards protein, phosphorus and lime content.

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The use of Gammexane for the control of White Grubs and Wire Worms in Tobacco Lands.

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Introduction. Trials with Gammexane (Gamma isomer of benzene hexachloride) for the control of various species of white grubs (*Anomala*, *Schizonycha*, *Adoretus*) and false wire worms (*Psamnodes similis*) in tobacco lands were commenced by Mitchell in 1945. (Rhodesia Agricultural Journal, 1946.)

Mitchell applied 0.50 Gammexane dust at rates ranging from 25 to 200 lbs. per acre. The Gammexane was mixed with the fertiliser and applied round the marker seven days before planting. Stand counts were not made, but plots were sampled for grubs and wire worms approximately two and seven weeks after planting. The results showed a significant decrease in the population of both white grubs and wire worms compared with the untreated plots, while the white grub population showed a considerable drop in the second sample compared with the first; there was no further drop in the wire worm population after the initial sample. From these results, Mitchell concluded that the Gammexane should be applied some weeks before planting in order to give the insecticide time to effect the maximum kill, and that broadcasting was more likely to be effective than local application round the plant. Even the highest application of Gammexane did not give a complete kill, and since the results were based on grub counts, it was not certain whether the proportion of grubs destroyed would materially affect the stand of tobacco.

On Mitchell's leaving the Station in 1946, Gammexane trials were carried on by the present author, the preliminary treatments being based on the previous findings.

TESTS IN 1946-47 SEASON.

Two identical trials were planned. One of these, "A," was not planted to tobacco, but counts of the white grub and wire worm populations were made, while the other, "B," was planted to tobacco and an analysis made of the loss of stand due to various causes.

* Two types of dust were used (designated "type 1" and "type 2") with seven different concentrations of Gammexane in each type of dust.

* Type 1 dust came from African Explosives and Chemical Industries, Ltd., Northrand, and Type 2 from Umbogintwini, Natal.

The dusts were broadcast at the rate of 300 lbs. per acre on 20th November, 1946. After broadcasting, the Gammexane was dug under to a depth of three to four inches. Sampling of experiment A was commenced on January 8th, 1947—seven weeks after the application of Gammexane, while trial B was planted to tobacco on 30th December, 1946.

Trial A (1946-47). The plots in this experiment were 70 square yards in area with six replications of each treatment. Seven samples of 1 square yard each were taken at random in each plot and the numbers of white grubs and wire worms recorded. No attempt was made to divide the white grubs into the various species.

The results of this sampling are given in Table I.

TABLE I.

Trial A (1946-47). Numbers of white grubs and wire worms in 42 square yard samples following Gammexane treatments.

Percentage Gammexane.	Type of Gammexane.	Number of White Grubs.	Total Types 1 & 2.	Number of Wire Worms.	Total Types 1 & 2.
0.50	1	23	46	8	9
	2	23		1	
0.40	1	20	37	10	12
	2	17		2	
0.33	1	69	89	7	9
	2	20		2	
0.25	1	28	67	8	13
	2	39		5	
0.17	1	40	71	8	24
	2	31		16	
0.08	1	32	67	21	36
	2	35		15	
0.04	1	87	130	43	57
	2	43		14	
0.00	1	179	290	43	90
	2	111		47	
Total	1	299		105	
Total	2	208		55	

Significant differences:—

Type 2 better than Type 1 for both white grubs and wire worms.

White Grubs: No significant difference between the percentages of Gammexane.

Wire Worms: No significant difference between 0.50 to 0.25%.

0.50 and 0.33% better than 0.17%.

0.50-0.25% better than 0.08%.

0.50-0.08% better than 0.04%.

Type 2 dust gave a significantly higher kill than Type 1 for both white grubs and wire worms.

Although there was some increase in the number of white grubs with the decreasing concentration of Gammexane, the differences did not approach the level of significance. The number of wire worms remained constant between concentrations 0.50% and 0.25% of Gammexane, but lower percentages gave a significant increase in numbers. All treatments were very obviously better than the controls for both white grubs and wire worms.

Trial B. (1946-47). The land was fertilised and filled in the normal way, tobacco being planted on 30th December—40 days after the application of Gammexane. No refilling was done after the initial planting. Three weeks after planting, plots were scored for stand, and an analysis made of the various causes of loss. The results of this analysis are given in Table II.

Significant differences:—

White grubs: No difference between percentages Gammexane.

Wire worms: 0.50%-0.17% better than 0.08% or 0.04%.

Unidentified—Causes unknown: No significant differences between Gammexane treatments.

The loss of stand due to white grubs was low throughout all the Gammexane treatments, no significant difference occurring between the highest and the lowest concentrations. All treatments were better than the untreated.

The loss of stand due to wire worms was low between 0.50 and 0.25 percentages, but showed a tendency to increase as the concentration dropped below 0.17%. Concentrations between 0.50 and 0.17 percentages (inclusive) were all significantly better than the 0.08 or 0.04 percentages.

TABLE II.

Gammexane Trial (1946-47). Percentage loss of stand due to various causes.

Method of Application.	Broadcast 300 lbs. per acre.								Days before planting.							No treatment.
Treatment No. and % of	1	9	2	10	3	11	4	12	5	13	6	14	7	15	16
Gammexane.	0.50 (1)	0.50 (2)	0.40 (1)	0.40 (2)	0.33 (1)	0.33 (2)	0.25 (1)	0.25 (2)	0.17 (1)	0.17 (2)	0.08 (1)	0.08 (2)	0.04 (1)	0.04 (2)	0
Loss from—															
White grubs .	0.24	0.48	0.00	0.00	0.48	0.24	0.00	0.24	0.00	0.00	0.48	0.24	0.48	0.71	2.62
Wire worms	0.00	0.00	0.00	0.48	0.48	0.24	0.48	0.24	1.19	0.00	1.19	1.19	2.62	1.19	4.40
Unidentified insects	0.71	0.00	0.24	0.24	1.19	1.19	0.71	0.24	1.43	1.90	0.00	0.71	2.62	1.69	3.69
Causes unknown	1.90	1.67	2.62	1.90	2.62	2.38	1.67	1.67	2.86	2.86	2.86	1.43	1.43	3.81	3.33
All causes except crickets	2.85	2.15	2.86	2.62	4.77	4.05	2.86	2.39	5.48	4.76	4.53	3.57	7.15	7.40	14.04
Crickets . . .	5.95	3.57	2.62	3.33	5.48	6.43	2.14	2.86	6.19	5.48	5.71	4.28	3.57	3.57	6.24
Stand at 3 weeks (%) .	91.2	94.3	94.5	94.0	89.8	89.5	95.0	94.8	88.3	89.8	89.8	92.1	89.3	89.0	79.7
Stand at maturity	90.1	92.5	90.2	90.4	86.4	85.4	92.5	92.7	82.1	83.9	85.2	86.9	85.4	83.1	68.2

TABLE III.

Gammexane Trial (1946-47). Residual Effects of Gammexane in 1947-48.
(Percentage loss of stand due to various causes.)

Method of Application.	Broadcast 300 lbs. per acre.							Days before planting.								No treatment.
Treatment No. and % of Gammexane.	1 0.50 (1)	9 0.50 (2)	2 0.40 (1)	10 0.40 (2)	3 0.33 (1)	11 0.33 (2)	4 0.25 (1)	12 0.25 (2)	5 0.17 (1)	13 0.17 (2)	6 0.08 (1)	14 0.08 (2)	7 0.04 (1)	15 0.08 (2)	0
Loss from—															
White grubs	0.00	0.00	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.95	0.00	1.19	0.95	0.71
Wire worms	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.95	0.00	1.90	0.71	1.67	1.43	0.95
Unidentified insects ...	0.71	0.48	0.24	0.00	0.71	0.48	0.71	0.95	0.95	0.48	2.86	1.43	4.28	4.05	4.17
Causes unknown	0.24	1.69	0.48	0.48	0.71	0.95	1.69	0.48	2.86	1.19	6.19	3.09	5.24	5.48	5.83
All causes except crickets . ..	0.95	2.17	0.96	0.48	1.42	1.43	2.40	1.67	4.76	1.67	11.90	5.23	12.38	11.91	11.66
Crickets .. .	18.57	19.52	14.28	11.90	20.48	14 28	16.90	15.71	13.57	15.24	16.67	9.76	14.76	17.38	13.21
Regeneration after crickets	36.00	19.50	31.70	26.50	22.10	33.30	26.80	16.70	17.60	11.30	22.90	27.00	25.80	24.70	15.25
Mature stand (%)	85.71	82.86	88.57	90.00	80.00	85.71	82.86	81.43	80.00	81.43	75.71	84.28	75.71	67.14	75.71

Losses due to unidentified insects and causes unknown were higher in the controls than the treated plots, but did not differ significantly within treated plots.

The loss due to crickets (*Maxentius pinquis*) was taken at random over the whole experimental area, and there was no indication that Gammexane had affected the crickets in any way.

The significant difference between the two types of Gammexane dust, which was apparent in the grub counts, did not show up in the stand counts, the mature stand for Type 1 being almost identical with that for Type 2. This suggested that while the grubs and wire worm were not killed as quickly by Type 1 dust, they were rendered incapable of attacking the plants. If this were the case, then counts of grubs killed are not necessarily a criterion of the efficacy of the treatment, and the possibility of applying Gammexane closer to the time of planting became evident.

Residual Effects from 1946-47 Trial. The plots treated with Gammexane in 1946 were planted to tobacco again in 1947-48 season to determine whether any effect remained over for another season. Tobacco was planted on 17th December—a time in the season when insect attack is normally heaviest. The loss of stand was scored on 1st and 9th January, 1948. The loss of stand due to various causes is shown in Table III.

On scoring the stand in this experiment, very few living white grubs or wire worms were found, but the loss of stand due to unidentified insects or causes unknown were obviously due to one or other. The statistical analysis was made on loss due to all causes except crickets only.

The results showed a remarkable similarity to those of the previous year.

The concentrations 0.50 to 0.33 percentages were all better than 0.17 to 0.04 percentages, while 0.17% was better than 0.08% and 0.08% than 0.04%.

Below a concentration of 0.17% there is a sharp drop in stand, and the concentrations 0.08 and 0.04 percentages show no residual effect when compared with the control.

The higher concentrations of Gammexane have, however, left a very marked residual effect, resulting in a loss of stand of only about 2%, excluding losses due to crickets.

It is interesting to note that Type 2 dust, which was significantly better on grub counts but not on stand counts in the 1946/47 season, has had a significantly better residual effect than Type 1.

The damage due to crickets was heavy, and once again there was no indication that Gammexane had any effect.

Significant differences (all causes except crickets):

Type 2 better than type 1.
No difference between 0.05% - 0.33%.
0.50%-0.33% better than 0.17%.
0.50%-0.17% better than 0.08%.
0.50%-0.08% better than 0.04%.

Gammexane Trials (1947-48). The experiments in 1946-47 showed clearly that concentrations of Gammexane higher than 0.25% broadcast at 300 lbs. per acre gave a high degree of control of white grubs and wire worms. Although this treatment is highly effective, the cost (which would be about £7 10s. per acre for 0.25% Gammexane) would probably prohibit its use on a wide scale. It was decided, therefore, to endeavour to reduce the cost by treating the area of soil round the plant only, instead of the whole field, and at the same time to determine whether the Gammexane could not be applied closer to the time of planting and still be equally effective, thus permitting the possibility of incorporation in initial fertiliser dressing.

Three trials were carried out, as follows:—

"A." Comparing early and late applications of Gammexane both broadcast over the whole area and localised round the marker only.

"B." Gammexane broadcast and round the marker applied 33 days before planting.

"C." Gammexane broadcast and round marker one day before planting.

Trial "A" (1947-48). Three dusts containing 0.50, 0.25 and 0.08 percentages Gammexane were used.

Each of these was broadcast at the rate of 300 lbs. per acre 33 days before planting and one day before planting.

The same three dusts were also given, as a local application round the marker only, on the same dates. The rate of application per unit area of soil was the same as in the broadcast treatments, but only 1/6th of the soil was treated, thus reducing the rate of application from 300 lbs. to 50 lbs. per acre.

When broadcasting, the dusts were weighed out per plot, broadcast by hand and dug under to a depth of three or four inches.

For the local applications, the quantity per plot was also weighed, but the amount per marker was measured by means of a fertiliser cup. It was found that a 100 lbs. fertiliser cup gave almost exactly 50 lbs. per acre Gammexane dust. The local applications were dug lightly into the soil around the marker, but hills were not made until fertiliser was applied.

The early applications of Gammexane were made on 15th November, 1947, the later applications on 18th December, 1947. Fertiliser was applied to all treatments on 19th December and the land hilled and planted on the same day. An initial scoring of stand losses was made on 30th December, followed by a second scoring on 8th January, 1948. The results are summarised in Table IV.

TABLE IV.

Trial A (1947-48). Percentage loss of stand due to various causes, regeneration following cricket damage and mature percentage stand.

Method of Application.	Broadcast 300 lbs. per acre 33 days before			Broadcast 300 lbs. per acre 1 day before			Round marker only 33 days before (50 lbs. per acre)			Round marker only 1 day before (50 lbs. per acre)			No treatment
Treatment No. and % of	2	3	4	6	7	8	10	11	12	14	15	16	
Gammexane.	0.08	0.25	0.50	0.08	0.25	0.50	0.08	0.25	0 50	0.08	0.25	0.50	0
Loss from—													
White grubs ..	0.77	0.38	0.19	2.11	0.38	0.38	2.88	3.65	1.15	2.50	2.69	1.35	15.67
Wire worms . . .	1.35	0.00	0.19	0.77	0.00	0.19	5.00	2.11	0.77	0.77	0.96	0.19	8.75
Unidentified insects	2.69	1.35	0.19	1.15	1.15	0.77	3.08	3.46	2.11	2.31	1.35	1.35	6.97
Causes unknown	1.92	1.15	0.00	0.77	0.77	0.38	2.50	1.54	1.54	1.15	0.58	0.96	2.84
All causes except crickets	6.73	2.88	0.58	4.81	2.31	1.73	13.46	10.77	5.58	6.73	5.58	3.85	34.23
Crickets .	17.15	14.23	6.54	19.04	11.15	15.77	22.11	22.31	19.04	25.78	19.42	17.31	17.64
% regeneration after crickets . .	25.84	31.08	35.30	47.48	37.93	26.83	23.48	24.14	34.35	17.16	37.63	42.23	17.06
Mature stand (%) .	80.96	88.65	93.85	85.19	88.65	86.54	67.88	72.88	80.19	69.61	82.31	88.46	47.60

Significant differences:—

White grubs:
3, 4, 7 and 8 better than 10, 11, 14 and 15.
2 better than 14 and 15.

Wire worms:
3 and 7 better than 2, 10, 11 and 15.
4, 7, 8 and 16 better than 2, 10, 11 and 15.
All treatments better than 10.

Causes unknown:
4 better than 2, 10, 11 and 12.
8 better than 2, 10 and 12.
15 better than 2 and 10.
7 and 16 better than 10.

All causes:
4 better than 2, 6, 10, 11, 12, 14, 15 and 16.
7 and 8 better than 2, 10, 11, 12, 14 and 15.
3 better than 2, 10 and 11.
12, 15 and 16 better than 10 and 11.

The loss of stand due to white grubs, wire worms, unidentified insects or causes unknown was low in all treatments compared with the non-treated plots. Even the lowest treatment, 0.08% Gammexane dust at 50 lbs. per acre, has reduced the loss of stand from all causes* from 34.23% to 13.46%. The time of application had little effect, Gammexane applied immediately before planting being equally as effective as applications 33 days before planting.

Local applications immediately before planting appeared to be more effective against wire worms than local applications 33 days before planting.

The later applications, applied locally, were almost as effective against wire worms as the broadcast treatments, although two of the treatments (14 and 15) gave a much lower rate of Gammexane per acre than the lowest broadcast application.

In this experiment, on the basis of losses due to all causes, on applying the same amount of Gammexane per acre, there seemed to be little difference in effectiveness whether the amount was broadcast over the whole area as a dilute dust or localised round the plant as a more concentrated dust. This is shown by the comparisons between treatments 2 and 6 (0.08% broadcast 300 lbs. per acre) and treatments 12 and 16 (0.50% round marker giving 50 lbs. per acre).

The treatments all give about 0.25 lbs. of actual Gammexane per acre.

Trials "B" and "C" (1947-48). The same treatments as in trial "A" were tested further in two smaller experiments. Applications of Gammexane 33 days before planting, both round the marker and broadcast, were tested in "B," and similar applications one day before planting in "C."

The results from these experiments are shown in Tables V and VI.

*In discussing the results, "all causes" means the combined loss of stand due to white grubs, wire worms, unidentified insects and causes unknown, but does not include loss due to crickets.

TABLE V.

Gammexane Trial B (1947-48). Early Application.

(Percentage loss of stand due to various causes, regeneration following cricket damage and mature percentage stand.)

Method of Application	Broadcast (300 lbs. per acre)			Round marker only (50 lbs. per acre)			No treatment
Treatment No. and % Gammexane	1 0.08	2 0.25	3 0.50	4 0.08	5 0.25	6 0.50	7 0
Loss from—							
White grubs	0.48	0.00	0.00	7.93	8.17	1.92	22.60
Wire worms ..	0.96	0.00	0.00	3.36	2.88	0.96	7.21
Unidentified insects	2.40	0.96	0.72	2.40	1.92	0.96	4.33
Causes unknown	0.96	1.20	1.44	1.68	1.92	1.20	2.88
All causes except crickets	4.80	2.16	2.16	15.37	14.89	5.04	37.02
Crickets	14.66	9.13	6.73	20.67	11.30	8.41	16.10
Regeneration after crickets	24.16	18.4	17.8	25.6	38.3	51.4	19.4
Mature stand	83.9	90.9	91.3	68.5	78.6	88.5	48.3

Significant differences:—

White grubs:

All treatments better than control.
1, 2, 3 and 6 better than 4 and 5.
2 and 3 better than 6.

Wire worms:

All treatments better than control.
1, 2, 3 and 6 better than 4 and 5.

Unidentified insects:

All treatments better than control.
2, 3 and 6 better than 1 and 4.
2 better than 5.
3 almost better than 2 and 6.

All causes:

All treatments better than control.
2 and 3 better than 1, 4, 5 and 6.
1 and 6 better than 4 and 5.

TABLE VI.

Gammexane Trial C (1947-48). Late Application.

(Percentage loss of stand due to various causes, regeneration following cricket damage and mature percentage stand.)

Method of Application	Broadcast (300 lbs. per acre)			Round marker only (50 lbs. per acre)			No treatment
Treatment No. and % Gammexane	1 0.08	2 0.25	3 0.50	4 0.08	5 0.25	6 0.50	7 0
Loss from—							
White grubs	2.40	0.24	0.24	11.30	2.40	2.16	11.54
Wire worms	0.96	0.00	0.00	1.68	0.72	0.48	5.29
Unidentified insects	0.72	0.00	0.48	2.88	1.44	0.72	3.60
Causes unknown .	0.96	0.00	0 00	0.48	1.92	0.72	2.16
All causes except crickets	5.04	0.24	0.72	16.34	6.48	4.08	22.59
Crickets	22.11	22.11	24.04	32.21	20.19	26.20	34.85
Regeneration after crickets (%)	18.45	26.09	37.00	20.15	19.05	17.44	11.72
Mature stand .	77.16	82.45	86.06	56.49	75.48	71.63	43.99

Significant differences:—

White grubs:

All treatments better than control.

2 and 3 better than 1, 4, 5 and 6.

Wire worms:

Not significant.

Unidentified insects:

2 better than 4, 5 and 7.

1, 3 and 6 better than 4 and 7.

5 better than 7.

All causes:

All treatments better than control.

2 and 3 better than 1, 4, 5 and 6.

1, 5 and 6 better than 4.

The weight of insect attack was very heavy in trial "B," more especially that of white grubs. In this experiment 22.60% of the plants were destroyed by white grubs in non-treated plots compared with 15.67% in trial "A." The broadcast treatments were much more effective than localised treatments against white grubs. The local treatments, however, showed a fair measure of control compared with the non-treated plots.

The weight of attack in trial "C" (applications immediately before planting) was not so heavy. In this trial the lowest application (0.08% 50 lbs. per acre localised) has only given a 6% reduction in loss of stand compared with the controls.

The results of the three experiments are summarised on the basis of losses due to all causes except crickets. Unidentified insects are almost certainly either white grubs or wire worms, while the fact that the loss due to "causes unknown" is always greater in control plots than in treated plots, indicates that a considerable part of these losses is due to insect attack.

The summarised results of the three experiments (Table VII) show that on the whole Gammexane applied immediately before planting has been more effective than Gammexane applied 33 days before. The results are somewhat confused by the extensive damage caused by crickets, but even so, a single application of Gammexane with no refilling has given a higher percentage mature stand than it is often possible to obtain on untreated plots even with constant refilling.

TABLE VII.

Mean percentage loss of stand in Trials A, B and C (1947-48) due to all causes, except crickets, and percentage stand at maturity.

Method of Application	Percentage Gammexane	Trial A	Trial B	Trial C	Mean of A, B, C.	Mean mature % stand, A, B, C.	Approximate cost of treatment per acre £ s. d.
300 lbs. per acre broadcast 33 days before planting	0.08	6.73	4.80	—	5.76	82.43	2 10 0
	0.25	2.88	2.16	—	2.52	89.77	7 10 0
	0.50	0.58	2.16	—	1.37	92.57	15 0 0
300 lbs. per acre broadcast 1 day before planting	0.08	4.81	—	5.04	4.92	81.17	2 10 0
	0.25	2.31	—	0.24	1.27	85.55	7 10 0
	0.50	1.73	—	0.72	1.22	86.30	15 0 0
50 lbs. per acre round marker 33 days before planting	0.08	13.46	15.37	—	14.41	68.19	0 8 6
	0.25	10.77	14.87	—	12.82	75.74	1 5 0
	0.50	5.58	5.04	—	5.31	84.34	2 10 0
50 lbs. per acre round marker 1 day before planting	0.08	6.73	—	16.34	11.53	63.05	0 8 6
	0.25	5.58	—	6.48	6.03	78.89	1 5 0
	0.50	3.85	—	4.08	3.96	80.04	2 10 0
No treatment ..	—	34.23	37.02	22.59	31.28	46.63	—

Gammexane Treatment Before Refilling. Once it was established that Gammexane, applied immediately before planting, was equally as effective as when applied some weeks before planting, the possibility of treating hills with missing plants became apparent. A land which had already been refilled twice with little success was chosen for the test. A 100 lb. fertiliser cup of 0.25% Gemmaxane dust was scattered round the "mark" of the missing plant and then mixed with the soil. In spite of adverse weather conditions, a very high percentage of the "refills" survived. This method was found to be much less laborious and much more effective than digging out the offending wire worm or white grub.

Discussion. The experiments carried out were designed to determine the protection afforded by Gammexane when no attempt was made to build up the maximum stand by refilling. While it is obvious that a very considerable amount of experimental work will be required to determine the optimum time and method of application, the results obtained already show that Gammexane has immediate possibilities on a commercial scale.

The ideal application of Gammexane would be one which gave a high percentage stand without refilling, since an even initial stand would facilitate reaping, curing and grading. While such an application appears feasible, the cost at present would be too high for commercial use. Some compromise must, therefore, be reached between percentage stand and cost per acre. Two facts of importance in commercial application have been established:—

(1) Even very low applications of Gammexane afford considerable protection against white grubs and wire worm attack.

(2) Gammexane is effective whether applied immediately before planting or several weeks before planting.

The first fact permits the use of Gammexane in sufficiently small quantities to reduce the cost per acre to reasonable proportions whilst still getting a good stand, whereas the second allows the treatment of hills, where plants have been destroyed, before refilling.

The method of application depends upon the anticipated insect attack. On new land a good stand is usually obtained, and it would seem wasteful to treat the whole land. In this case it would be logical to give no treatment prior to planting, but to treat hills where plants have been destroyed and then to refill once. The same argument may be applied to early plantings which are normally less subject to attack by insects, but since early plantings are frequently followed by periods of dry weather (when refilling is impossible) some growers may feel it worthwhile going to the expense of a preliminary treatment of the land before planting to ensure a good stand and even growth.

When a heavy attack of wire worms and white grubs can be expected, a preliminary treatment of the land would seem to be necessary. When a heavy attack of white grubs and wire worms occurs, the stand continues to dwindle up to four weeks or more

after planting, depending upon the weather conditions. Furthermore, many plants not actually killed are attacked and partially injured and fail to make good growth. Unless the initial attack can be reduced to reasonable proportions, treatment of hills after planting is likely to prove a long process, and even then an erratic stand and uneven growth are probable.

For land likely to be heavily infested, a preliminary dressing equivalent to 0.25% Gammexane dust applied locally at the rate of 50 lbs. per acre should give a high measure of control. Further treatment of the hills where plants are missing, followed by one refilling, should ensure a high percentage stand.

The relative merits of broadcast and localised applications have not been fully established. The suggested treatment—0.25% at 50 lbs. per acre—gives almost the same application as the 0.04% dust broadcast at 300 lbs. per acre in 1946-47. In spite of the much heavier insect attack in 1947-48, the loss of stand in the localised dressing was less than when the same amount of Gammexane per acre was broadcast.

When broadcast, Gammexane automatically becomes concentrated round the plant position by the ridging or hilling process. When making local applications, care should be taken to see that the Gammexane is concentrated as far as possible round the area where the plant is to be set. On the Research Station, local applications were made round the marker, mixed with the soil, and the hill built on top. It is possible that if the Gammexane were applied to the surface after ridging or hilling and then mixed with the soil to a depth of three or four inches, a more effective protection would be obtained.

For treatment of hills before refilling, a 100 lb. fertiliser cup of 0.25% Gammexane was applied on the surface where the plant was missing and then thoroughly mixed with the soil. The plant position was then marked with a straw to ensure the plant being set in the Gammexane-treated area. The treatment is probably more effective if carried out a day or two before refilling.

The residual potency of Gammexane in the season following that of application may be of great importance if it can be established that the potency remains after different types of wet seasons. If the residual effect is consistent, then it is a strong argument in favour of broadcasting as opposed to local applications. It cannot be expected that local applications will have any residual effect unless the plants are placed in the same hills in the following season.

Gammexane proved to be ineffective against crickets, in spite of the burrowing habit of the insects, which must have brought them into contact with the insecticide. The attack of cut-worms was not sufficiently heavy to draw any conclusions whatsoever.

Summary.

(1) Gammexane has proved to be a very effective insecticide for the control of both white grubs and false wire worms in tobacco lands.

(2) Gammexane may be applied immediately before planting or several weeks before, and is effective either broadcast or applied as local dressings round the plant. The relative merits of the two methods of application have not been fully determined.

(3) The higher applications, while being very effective, are too expensive for commercial use. Suggestions are put forward for the use of lighter dressings followed by one refilling, which should ensure a good stand at reasonable cost.

(4) Gammexane may be used effectively to treat hills where plants are missing before refilling.

(5) The insecticide proved ineffective against crickets. The attack of cut-worms was not sufficiently high to draw any conclusions.

(6) The Gammexane applied in 1946-47 had a residual effect in the 1947-48 season, the heavier applications giving a high degree of control of wire worms and white grubs.

Acknowledgments. Messrs. African Explosives & Chemical Industries, Ltd., kindly supplied the Gammexane dust ready mixed.

I am indebted for the assistance of my colleagues with field scoring, more particularly to Major D. C. Bell, who carried out the main portion of field counts in the 1947-48 season.

Soya Beans

By H. C. ARNOLD, Manager, Agricultural Experiment Station.

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Notes on Cultivation.—The exceptional qualities which nature has bestowed on the soya bean, combined with its suitability for storing and transportation, make the crop worthy of serious attention by the farmers of this Colony. No other food crop suitable for large scale cultivation under local climatic conditions possesses so many desirable characteristics. The beans contain a high proportion of proteins, oils and vitamins, as well as other valuable nutrients. They can be used for human consumption as well as for all classes of farm livestock. They are more resistant to drought than maize and can be more easily grown, reaped, threshed and stored than any other types of edible beans. The growing plants are not seriously affected by insect pests and the seed is not attacked by weevils. Soya beans thrive on a wide range of soil types, provided they contain sufficient humus and phosphate and are not excessively acid. The demands of the reaped crop on the plant nutrients of the soil are lower than those of maize, and if the whole crop is ploughed under for green manure, the beneficial effect on the cropping power of the soil is comparable with that of sunnhemp when used for the same purpose.

The improvement in the varieties suitable for local climatic conditions, which has been effected by the introduction of non-shattering types and breeding them with heavy croppers, has provided the farmers of this Colony with another crop which can be economically cultivated.

The purpose of this article is to present the information we have gathered so far about the methods of cultivation found suitable for local conditions, and to suggest methods for the utilisation of the soya bean crop.

The varieties available fall into two distinct groups, namely, those whose seed is especially suited for edible and manufacturing purposes and others whose heavy yields of fodder make them particularly suited for use as hay or silage.

Edible and Manufacturing Varieties.—As a general rule only those with light coloured seed coats—usually cream to creamy yellow—are acceptable to the milling trade, and only such should be grown when it is intended to use the seed for human consumption either in the unprocessed or the manufactured state. Furthermore, our new yellow-seeded varieties yield heavier crops of seed than the fodder kinds.

Two years ago the only variety which could be recommended for large scale sowing was one known as Potchefstroom No. 184, but since that time the Hernon strains evolved at this Station

have been distributed to all parts of the Colony, and these have yielded heavier crops than the former variety in nearly every instance. One or two farmers reported that they prefer the Poschefstroom No. 184 because it matures more quickly than the Hernon strains. Many farmers planted their soya beans too late in the season to obtain the heaviest crop of seed. The best time for sowing the Hernons is early in the month of December. At that period of the year, however, most farmers are busy with other crops, and they find they cannot sow their soya beans until the latter part of that month.

In order to ascertain whether the early maturing P. 184 variety would be more suitable than the Hernons for late planting, a trial was laid down last season in which the sowings were made each week between December 15th and January 19th inclusively. Six plots each of P. No. 184 and Hernon No. 107 were sown at each weekly interval. The average yields of each group of six plots are given in the tabulation below. P=Potchefstroom, H=Hernon.

	Sown Dec. 15th		Sown Dec. 22nd		Sown Dec. 29th	
Strain	P. 184	H. 107	P. 184	H. 107	P. 184	H. 107
Yields ... lbs.	882	1,107	915	974	784	799

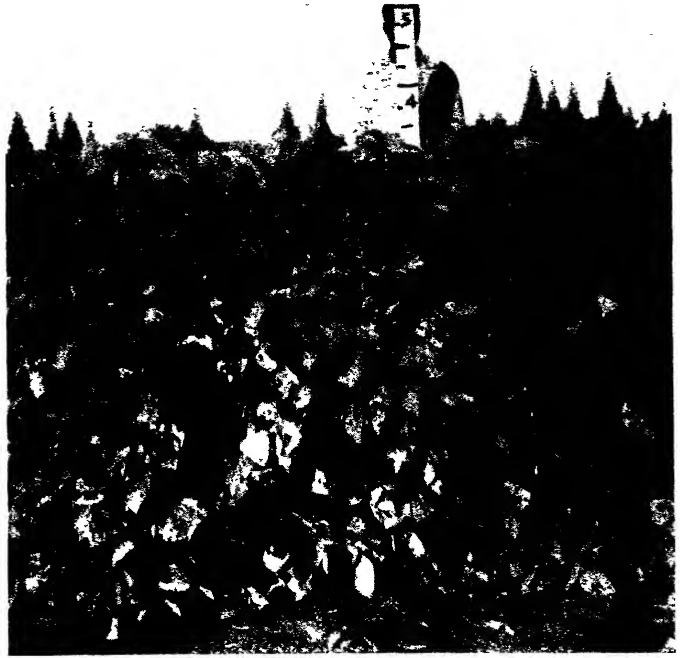
	Sown Jan. 5th		Sown Jan. 12th		Sown Jan. 19th	
Strain	P. 184	H. 107	P. 184	H. 107	P. 184	H. 107
Yields... lbs.	634	675	450	557	378	427

These returns show that in spite of its early maturity the P. 184 variety did not yield more heavily than the Hernon strain, even when sowing was deferred as late as January 19th.

It is also shown that late sowing reduces yields, and this fact should be kept in mind when farmers compare their cash returns from soya beans with that from other crops which may have had the advantage of a longer period of growth.

Strain Trials.—Several Hernon strains have been isued to farmers during the past two seasons. Of these, Nos. 18, 39 and 268 have consistently given satisfaction to the majority of those who have grown them. At this Station a more recent selection, namely, No. 107, produced heavier yields than the foregoing in previous seasons trials, but during the season just past, its yields, equalled, but were not heavier than those of Nos. 18 and 268. However, it retains its seed for a longer period than No. 268 without shattering, and it is more homogeneous than the other strains; for these reasons in future it will replace No. 268 in our trials. The position at the present time, therefore, is that strains Nos. 18 and 107 are considered to be the best. No. 39 yields as

Soya Bean Jubiltan Strain Grown at Veterinary Research Laboratories, Season 1940-41. This crop yielded over three tons per acre of very palatable and highly nutritious hay The colour of the seed coat of the Jubiltan strains makes them unsuited for human consumption,(but they produce larger quantities of fodder than the yellow seeded kinds



Soya Beans Hernon 268. Grown at the Agricultural Experiment Station, Salisbury Season 1940 41. This variety has edible yellow seed which is suited for industrial purposes Its robust habit of growth allows it to be used for hay if desired.

well as the others, but its dwarf habit of growth makes it less suited far machine harvesting. No. 107 has not been issued to farmers hitherto, but sufficient seed is now available for issues of a few pounds each to bona fide farmers in this Colony under our Co-operative Experiment scheme. In our strain trials last season these Hernon strains yielded 36 per cent. more seed than Poschefstroom No. 184. One reason for the yield of the Hernons being so much heavier than P. 184 in these trials is probably due to their having been sown early, viz., December 4th, 1941. In the date-of-planting trials cited above the Hernon No. 107 sown on December 15th yielded 25 per cent. more than P. No. 184, but from the January 19th sowing, the Hernon strain yielded only 13 per cent. more than P. No. 184. It is seen, therefore, that early sowing is associated with heavy yields, but the "best" time to sow will be influenced to some extent by the other operations on the farm, **for in spite of their "non-shattering" qualities, it is not advisable to delay harvesting the crop for more than a week or so after the leaves have dropped.**

The work of cross-breeding strains and testing promising selections is being continued with a view to effecting further improvements in the yield and seed-retaining ability of new strains. The ability to retain the seed in closed pods for some few weeks after the plants reach maturity would enable farmers to grow the crop on a wider scale, and to feel confident that they would not sustain loss should circumstances demand the postponement of harvesting operations.

Growers of the Hernon strain must remember that they are not entirely homogeneous, and it may be found that a few "off-type" plants will appear. The portion of the crop which is to be used for seed should be carefully inspected in the field, and plants with "off-type" habit of growth, pubescence of the leaves and stems, and those bearing a poor crop of pods and/or appearing diseased should be removed before the crop is reaped. Although a small proportion of dark coloured beans may not reduce the commercial value of the crop, all brown and black beans should be removed from the "seed" before it is sown in order that the creamy yellow colour normal to these strains may be maintained. Strains whose normal pubescence is grey are less likely to produce dark coloured seed than those whose pubescence is brown. *For this reason growers of Hernon Nos. 5, 36 and 39 would be well advised to change to a grey type such as Hernon Nos. 18 and 107 if they wish to grow soya beans for seed purposes.* As the differences in the appearance of the seed of the various Hernon strains are so small, it is impossible to identify them from seed alone, and it is, therefore, most important that the grower should carefully record the name of his strain in order that he may supply the correct name with every bag he sells for seed purposes. *Seed which is not correctly named will have little value above that of beans for commercial uses.*

Hernon No. 18.—The mature plant has several fine branches which are almost as long as the main stem, giving the plants an open or lax appearance. The terminal leaves are much narrower and more pointed than those formed in the early part of the season. Leaves and stems are covered with grey hairs. About

130 days are required to reach maturity. The seed is small to medium in size, light yellow in colour, "short kidney" in shape. The majority of the seeds have dark brown hilums, though a few have light brown hilum scars. The fine stems make it very suitable for use as hay. It is thus a good dual purpose type, giving good yields of hay if required, though not as heavy as the Jubiltan hay strains.

Hernon No. 107.—The mature plant has a single main stem with short side branches. The terminal leaves, though smaller, are about the same shape as those formed earlier in the season. Leaves and stem are covered with grey hairs. About 120 days are required to reach maturity. The seed is medium sized though slightly larger than that of No. 18, dull light yellow in colour, "short kidney" in shape. The hilum is small and light brown in colour.

At lower altitudes than that of this Station, such as in the Mazoe Valley, the periods required to reach maturity given above may be appreciably less, in some cases by as much as 1 to 3 weeks.

Soil and Rainfall Conditions.—As a general rule the soil and climatic conditions required by maize are those best suited for soya beans. During the season just past, when the rainfall was below the average amount, a number of farmers found their soya beans were less adversely affected than the maize on adjoining land, and it has been noted that this crop appears to be less sensitive than maize on land which is not well drained. Farmers who have grown soya beans and other edible beans (not velvet beans) in the same field, report that they have found the soya bean less exacting as regards soil conditions than the other kinds. On this Station the best crops have been produced in seasons in which the summer rainfall has ranged between 25 and 35 inches and has been evenly distributed. The range of soils suited for soya beans extends from loamy sands to fairly stiff clays, and those which are slightly acid to slightly alkaline, produce equally good crops. However, extremes should be avoided; soils which are shallow, waterlogged, very acid and sterile sands are quite unsuitable.

The humus content of the soil seems to be of great importance.—In the season 1938-39 when unusually wet and cold weather was experienced, the growth of the soya beans on this Station was noticed to be much more thrifty on certain parts than on others only a few feet away, although previous manurial treatments had been the same. Samples of soil from these areas were analysed by the Chief Chemist's Branch and it was found that although all the samples contained approximately the same amounts of inorganic plant foods, those which had produced the heaviest crops of soya beans contained a little more humus than the others The lack of sufficient humus had reduced the crop by 75 per cent. on some of the areas. Since that time further experiments and reports received from farmers have supported those conclusions. This suggests that soya beans may require conditions suitable for the development of mycorrhiza on their roots in addition to the nodule forming bacteria which are known to provide an

important source of the nitrogen requirements of the plants. In the absence of humus, growth is often found to be subnormal in spite of satisfactory bacterial nodulation of the roots.

Fertiliser Trials.—Experiments were conducted during the season 1940-41 in which dressings of phosphate and muriate of potash were applied both alone and also together. Each dressing was replicated eight times. The fertilised plots did not yield heavier crops than the unfertilised control plots. The ineffectiveness of the fertiliser may have been due to the unfavourable weather conditions, but it is thought that insufficient humus may have been a contributory cause also.

Trials which include dressings of 8 tons of kraal compost, 1 ton of lime, 200 lbs. of phosphatic fertiliser and 100 lbs. of potash per acre both as single and as combined dressings, were commenced in the season 1941 42. The results in the first season were inconclusive, owing to a portion of the land being more severely affected by the drought than the remainder, and to inherent inequalities in the fertility of the land. At present the indications are that compost, phosphate and lime all had a beneficial effect, but that dressings of potash are not required under these soil conditions. It will be necesary to continue these trials over a number of seasons before it will be possible to assess the relative importance of those dressings which appear to have had a beneficial effect.

The experience acquired from farmers' reports and trials on this Station indicate that soya beans thrive best on soils which are fairly well drained, contain moderate amounts of humus and phosphate, and are not too acid.

Inoculation with Specific Bacteria.- It is well known that all leguminous farm crops live in symbiotic relationship with certain kinds of bacteria whose activities on the roots of the plants result in the transformation of free nitrogen of the air to a form in which it can be utilised by the plants, and is highly beneficial to them. The particular kind of bacteria favoured by the soya bean plant is not usually found in Rhodesian soils. For this reason when this crop is first grown on the land it is advisable to inoculate the seed to obtain the desired benefit from their activities. If the majority of the plants are found carrying the bacterial nodules, it will not be necessary to inoculate that land again, provided the interval between soya bean crops is not more than three or four years.

No investigational work designed to ascertain the longevity of these bacteria has been done in this Colony, but in America, after a period of eighteen years virile bacteria were found in certain soils, but as a rule the number in the soil decreases rapidly after two or three years. They disappear more quickly in acid than in neutral or alkaline soils. Although there are several methods of introducing the bacteria to the land, the simplest under present conditions are (a) smearing the seed with bacteria laden soil; (b) soaking the bacteria laden soil in milk (or water)for 24 to 36 hours and using the liquid to inoculate the seed. The latter method is preferable when the seed is to be sown with a machine.

Material for Inoculating the Seed.—A quantity of specially prepared soil is available at the Agricultural Experiment Station, Salisbury, for distribution to farmers who are growing soya beans for the FIRST time. Sufficient to inoculate 400 lbs. of seed will be sent free of charge upon application to the Manager. For the second year's crop the farmer should grow his own bacteria by sowing inoculated beans, or some of the "bacterial soil" supplied, on a few square yards in a convenient place. The soil should be well supplied with compost and phosphate and the seed should be sown about 4 inches apart each way. The roots of the plants will spread through every inch of this soil and the bacteria will thoroughly permeate it. Soil prepared in this way will be more heavily laden with bacteria than that obtained from land planted at ordinary spacings. Alternatively, suitable material can be obtained by taking soil from near the taproots of plants carrying a satisfactory number of nodules. The *nodule bearing* roots can also be collected, reduced to powder by passing through a hammer mill and used instead of soil for inoculating the seed.

Seed Inoculation: The Dry Soil Method.—The seed should first be thoroughly coated with either skimmed milk, sugar solution, or very thin glue to ensure that the bacteria laden soil will adhere to it. While the seed is still wet, sprinkle the soil over it and turn it over and over in order that every seed may be smeared with the soil. A little raw rock phosphate should also be applied to the seed as it is being turned. When the beans are to be machine sown, any excess of soil should be removed by vigorously sifting the dried seed, in order that the loose soil may not cause clogging and wear in the drill boxes.

The Muddy-milk Method.—Allow 2 or 3 pints of milk for each bag of seed beans; boil it and allow to cool. Put in a vessel and pour 2 or 3 lbs. of soil into it. Stir well.

The milk may be poured off and used at once if desired, but better results were obtained in tests, from milk which had remained with the soil from 18 to 36 hours before application to the beans. The soil-milk mixture should be kept in a cool place in order that coagulation may be prevented. Before using stir the mud and milk, allow the larger particles of soil to settle, and pour off the liquid. Make a heap of the beans on a hard floor, sprinkle the muddy milk on them, turning them over meanwhile to ensure that every bean gets its share. A handful of raw rock phosphate should be sprinkled over the wet beans. Care should be taken not to moisten the beans so much that their coats wrinkle. If it is found that an excess of moisture has been applied, the seed can be dried off by applying dry soil, or rock phosphate.

Keep the inoculated seed away from bright sunlight. Immediately after inoculation spread the seed thinly in a shady place until it is thoroughly dry. It may then be bagged and kept until required for sowing. It may be kept for several weeks if necessary, but is best used soon after treatment. Drilling the seed is preferable to broadcasting, but if the latter method must be adopted, sow on a cloudy day and cover the seed as quickly as possible.

Inoculation not only increases the crop to which it is applied, but the residues which remain in the soil have a more beneficial effect on the crops which follow. If it is desired to thoroughly establish these bacteria in the soil, a dressing of lime should be given if it is found necessary to correct soil acidity, and a second crop of soya beans should follow the inoculated crop either in the first or second season.

SOWING THE SEED.

Early Sowing is Best.—Generally, the heaviest yields are obtained from varieties which require the longest period to reach maturity. It is not advisable to sow before the rains commence, because the seed cannot survive conditions which are unfavourable for steady growth after germination has been started. From the latter part of November to the middle of December is the most suitable period for sowing our heaviest producers, but sowing may continue until the end of December or later, at the risk of reaping reduced yields if the rainy season is curtailed. The trials mentioned above in which two varieties were sown at weekly intervals between December 15th, 1941, and January 19th, 1942, show that every week's delay in sowing the crop after mid-December has passed, increases the risk of reducing the yield. The crop of Hernon No. 107 sown on December 15th, yielded 5½ bags per acre, but that sown on January 19th yielded only two bags per acre.

How to Sow.—The drilling machines used for maize and also those for wheat can be adapted for soya beans. In the U.S. of America a large part of the crop is sown with grain drills which place the seed in rows eight inches apart, and about 100 lbs. of seed per acre is usually sown. The spike harrows and rotary hoes subsequently used to weed the crop reduce the stand somewhat. The best distance between rows for Rhodesian conditions has still to be determined. Much depends on the kind of sowing and weeding implements the farmer proposes to use. Experiments conducted in America show that it is almost impossible to reduce the yield by sowing too thickly. Nevertheless in districts in which the normal rainfall is insufficient to produce satisfactory crops of maize, it would be advisable to refrain from sowing too closely. In order that the weeds which appear during the early stages in the growth of the bean crop may be dealt with by means of drag harrows, it is advisable to aim at securing a stand which is dense enough to allow for a number of casualties resulting from the weeding operations.

Distance Planting Trials.—The first series of trials were conducted for three seasons. The distances between rows were 12 inches, 18 inches and 24 inches respectively, and the distance between seeds in the row 4 inches. Twelve blocks of randomised plots were sown. The results obtained in these trials as tabulated overleaf.

Yields of Seed in lbs. per Acre.

Season	Variety.	Rows 12 ins. apart.	Rows 18 ins. apart.	Rows 24 ins. apart.	Difference between 12 in. and 24 in. spacing.
1938-39	Mammoth	759	614	627	21%
1939-40	Pot. No. 184	1,485	1,408	1,307	14%
1940-41	Hernon No. 268	1,089	1,054	980	11%

Despite droughty conditions in the season 1940-41, the yield obtained from the 12 inch spacing was slightly heavier than that from the wider spacings, but the difference is seen to be so small that it is doubtful whether such close spacing would be as profitable as wider spacing which would require less seed, and less labour for weeding, etc. The difference in yield in favour of the close spacings has been lessened by the use of the Hernon variety. The robust habit of growth of this type enables it to make better use of the extra soil and air space provided by the wider spacings. The most economical spacing will be one which is wide enough to allow the operations of seeding and weeding to be expeditiously performed and close enough to produce a heavy yield of seed. Most farmers will wish to use the same implements for their soya beans as they employ for their other crops, and these are usually designed for rows which are at least 30 inches apart (small-grain drills excepted).

The majority of our farmers, therefore, find it is not practicable to sow in rows which are closely spaced, and during the season 1941-42 new trials were commenced which are designed to investigate the effect on yields of reducing the distance between the plants in the rows, when these are 30 inches apart. Spacings and yields obtained during last season are shown in the following tabulation:—

Yields of Seed in lbs. per Acre.

Spacing.	30 in. x 4 in.	30 in. x 2 in.	15 in. x 4 in.
Yield of seed... ...	1,432	1,561	1,593

These results show that when the rows are as far as 30 inches apart the plants should be closely crowded together in the rows, failing which the maximum crop of seed will not be obtained. The variety used in this trial was Hernon No. 107. This is a robust kind suited to wider spacings between rows than the pre-Hernon types. In this trial the yield of the 30 inch x 2 inch spacing was almost as large as that from the 15 inch x 4 inch spacing. This indicates that when the crop is grown on a field

scale the wide spacing between rows will probably be found the most economical, provided the plants are not further than 2 inches apart in the rows. At a spacing of 30 inches x 2 inches there will be 104,544 plants per acre. The weight of seed required to produce that number of plants will vary with the size of the beans, but it will usually be between 40 lbs. and 55 lbs.

Depth of Sowing. It is very important that the seed should be sown neither too shallow nor too deep. If the soil covering is too shallow there is a risk of insufficient moisture in the soil after germination has commenced, causing the death of the seedling. When the seed is placed too far down, the vitality of the seedling may be seriously impaired before it reaches the surface. Under average conditions from one and a half to two inches is the best depth. On light open soils deeper placement may be found advantageous, but on land which forms a hard crust after heavy rain, shallower and heavier seeding and dropping two or three seeds together in hills instead of evenly spacing the seed in a continuous row will help to secure a satisfactory stand. The use of depth regulators attached to the furrow openers, similar to those recommended for cotton planting, may be found necessary on loose soils.

Weeding. The rate of growth of young soya beans is slower than that of maize, and this makes it imperative that early and effective measures should be taken to destroy the weeds before they compete with the beans for the soil nutrients and moisture. By preparing a good seed-bed and destroying all weed growth at the time of sowing, the necessity for further weeding, until the plants are well above ground, may be avoided. It may then be possible to use weeders or light harrows without seriously reducing the stand, provided the surface is free from trash left over from the previous crop. Thorough weeding during the early stages of growth is of great importance in order that the crop may quickly outgrow weeds arising from later germinations. After reaching the age of six to eight weeks the beans form a dense canopy which effectively checks weed growth.

Harvesting. The crop is ready to harvest when the seed has reached the hard-dough stage, and most of the leaves have fallen from the plants. If cut too early, the seed will wrinkle and shrink; both weight and oil percentage will be reduced. The introduction of non-shattering strains enables farmers to leave the crop standing in the field until the leaves are practically all off. Some farmers may be tempted to harvest the seed crop before the leaves fall, thinking that by so doing they can get a better quality of straw—something approaching the quality of hay. There is no period, however, when soya beans can be cut and produce a crop of good hay and at the same time make a good crop of marketable seed. A hay crop will usually be cut three weeks or a month before the seed crop is ready to harvest. Only when the whole crop is to be used as fodder is there any advantage in cutting it before the seed is mature. The erect habit of growth of the soya bean plants enables them to be reaped with the same kind of machines as are commonly used for wheat. Some kinds have a tendency to form their pods rather too close

to the ground to allow the reaping machine to be used without leaving a portion of seed attached to the stubble. The remedy for this will be the choice of a naturally tall growing variety and favourable soil and cultural conditions. If a hay mowing machine is used, a sufficient number of labourers should be on the field to collect and tie the crop into bundles and move them out of the path of the machine, so as to avoid trampling the beans by the draught animals on the next round. Reaping machines which also bind the crop into bundles could be used to advantage. When such are employed it is advisable to harvest before the stalks and seed are thoroughly dry. When the risk of mildew development is past, these are bunched in shocks or stooks of convenient size and left until they are well dried, after which they may be stacked until it is convenient to thresh them. In America it has been found that machines which combine the operations of reaping and threshing reduce the cost of harvesting to one-half of that incurred when the operations of cutting, binding, stooking, loading, hauling to the stack, and threshing, are performed separately. Manufacturers of many types of threshing machines now supply the equipment needed for effecting the necessary adjustments. for threshing soya beans. Local farmers using machines normally built for maize, and at least one type constructed for wheat have given very satisfactory results during the past season.

Ordinary wheat threshers usually handle soya beans satisfactorily if a few adjustments are made. The adjustments necessary depend on the type of machine and the moisture content of the beans. Usually the speed of the cylinder must be reduced to approximately one-half of the normal rate. It may be found necessary to remove the first concave and substitute a wooden blank in order to reduce the proportion of chipped and broken beans. If the beans are damp it may be necessary to use all the concaves, but to remove one-half to two-thirds of the teeth. Lowering the concaves is usually necessary, particularly if the beans are very dry. It will be found that the adjustment necessary will depend to some extent on the moisture content of the beans and straw, and it will be advantageous to have uniformity of moisture content throughout the material. This can be ensured by stacking the material for a few days before attempting to thresh it. In America it has been found that the common grain threshers gave satisfactory results at a speed of 500 r.p.m. for a cylinder 18 inches in diameter. We are indebted to a local farmer—Mr. Peacocke, of Arcturus—for the information, that he found his Australian-made machine worked best with a cylinder speed of 850 r.p.m. when he treshed his crop straight from the field. It will generally be found necessary to keep the cleaning and elevating parts working at the normal speed by increasing the size of the pulley which drives those parts of the machine.

Growers of small areas will probably reap by hand, and unless the plants have exceptionally strong root systems it will be found less laborious to uproot them than to cut them off above ground; but discretion needs to be exercised before adopting this method. If the texture of the soil allows the plants to be uprooted in clean condition that method will be satisfactory, but if soil adheres to

the roots it may be found difficult to prevent it from becoming mixed with the seed, the value of which for milling purposes will then be reduced. In order that the seed may be kept clean and in good condition for edible purposes, cutting the stems above ground level is to be preferred. The stems are tough and well sharpened knives or sickles are required.

COMPARISON OF YIELDS OF SOYA BEANS WITH THOSE OF MAIZE.

Experience in this Colony as well as other countries has shown that in general the soil and climatic conditions required by soya beans are similar to those of maize. Farmers who have land and equipment suitable for maize cultivation will wish to know whether the production of soya beans is likely to prove as profitable as the production of maize. Investigations have been laid down with the object of finding the relative yield of maize and soya beans, but the trials are not complete and will need to continue for some few years before definite conclusions can be reached.

The plots in Crop Rotations F. and H. which were commenced in the season 1919-20, when maize was the principal crop throughout this Colony, were sub-divided in the season 1940-41. On the southern side the old rotations will continue as in the past, but soya beans have been introduced on the northern sub-divisions and in future they will alternate with the maize, in order that the rotational effect of soya beans may be compared with that of maize.

In both of the original rotations three crops of maize were grown in the four-year cycle. The manurial treatment in Rotation F. consists of one dressing of 8 tons of farmyard manure per acre and one of 200 lbs. superphosphate per acre, while in Rotation H. it is one crop of velvet beans ploughed under and two dressings of 200 lbs. each of phosphatic fertiliser per acre. In the season 1940-41, in the new rotation, soya beans for seed were sown in the place of velvet beans for ploughing under, but after the first season's results it was decided that it was inadvisable to delete green manure from the rotation and, commencing with the season just past, the amended rotation will be maize, soya beans, maize, velvet beans ploughed under for green manure.

The following tabulations show the manurial treatment of each of the plots during the past four years and the yields of maize and or soya beans obtained during the two seasons just concluded.

ROTATION F.

Manurial Treatments and Yields in Bags (200 lbs.) per Acre.

Seasons.	Plot B.	Plot C.	Plot D.	Plot E.
1938-39	Supers	Sudan	Nil	F.Y.M.
1939-40	F.Y.M.	Supers	Sudan	Nil
1940-41	Nil	F.Y.M.	Supers	Sudan
1941-42	Sudan hay	Nil	F.Y.M.	Supers
1940-41 Old Rot.	Maize 10.53	Maize 10.55	Maize 7.60	Sudan grass
1940-41 New Rot.	Maize 10.73	Soyas 5.76	Maize 8.73	Soyas 4.90
1941-42 New Rot.	Sudan	Maize 10.30	Maize 9.55	Maize 7.10
1941-42 Old Rot.	Soyas 5.93	Maize 11.93	Soyas 4.88	Maize 9.13

F.Y.M. = Farmyard Manure.

Average Yields.

	Maize.		Soya Beans.	
	Season 1940-41.	Season 1941-42.	Season 1940-41.	Season 1941-42.
Old Rotation	9.56	8.98	—	--
New Rotation......	9.73	10.53	5.33	5.40

Although the number of replications of the treatments in these trials is fewer than is considered necessary to obtain a high degree of accuracy, it may be claimed that the yields of maize obtained this season indicate that the maize crop benefited from the residue of the soya bean crop grown on the same land last season. This beneficial effect was also reflected in the vegetative growth of the maize, which was deeper green in colour and the stalks were thicker and taller. It may be noted also that in both seasons the yield of soya beans on this land was approximately half as many bags per acre as the yield of maize.

Owing to the alterations made in Rotation II., it is not possible to draw valid conclusions from the results obtained so far.

In the fertiliser and kraal manure trials cited above, maize, Hernon No. 107 soya beans and Somerset sunn hemp were sown across the various manurial dressings which occupy fifty plots in all. The average yields per acre over all the plots were as follows:—

Maize 2,645 lbs. Soya beans 1,207 lbs. Sunn hemp 825 lbs.
In this case, therefore, the yield of the soya beans was 45% of that of the maize.

Farmers assert that the cost per acre of growing and harvesting soya beans is about equal to that of growing maize, but there are other factors which favour the beans, e.g., they leave a residue which is beneficial to the next crop; they can be reaped and marketed earlier in the season; the land can be cleared and ploughed early; fewer grain bags and less transport are required

for marketing a crop of the same value; the threshed straw has a higher feeding value; the seed is not attacked by weevils and can be stored in open bins.

Market Prospects. The many ways in which soya beans can be used are now well known to most farmers in this Colony. The ease with which they can be transported and stored suggests that an outlet for any surplus which might be produced would not be difficult to find. In general, however, they can only be used for industrial purposes when supplies are plentiful and cheap. The market value in the immediate future will be governed largely by the extent to which they are used to replace more expensive foodstuffs, e.g., meat, wheaten flour, etc. If the crop is not fully utilised for such purposes, its market value will be governed by the prices paid for other agricultural products with similar industrial uses, e.g., cotton seed, ground nuts, etc. If it is found that soya beans can be grown more economically than ground nuts, they are likely to replace that crop to a large extent in our local industries and several thousands of bags will be required annually.

The general shortage of foodstuffs prevailing at the present time has increased values, and the price of commercial beans of good quality is now considerably more than £1 per 200 lbs.

METHODS OF USING AND NUTRITIVE VALUE.

It is self-evident that soya bean production will not flourish unless ways and means of utilising the beans are found, and for this reason every grower should acquaint himself with their merits and make use of them on his own farm to the fullest possible extent in so far as it is economical to do so. Many farmers are now using them daily for culinary purposes. Soya bean meal can be used to replace 20% of wheaten flour in home-made bread, cakes, scones, etc. These beans should form a part of the regular diet of all native employees on farms. When the farm natives have acquired a liking for them, their use will spread to the towns, mines, etc., and the local market will thus be increased.

The merits of soya beans as food for humans particularly as a substitute for eggs and meat because their proteins resemble those of animal origin are being increasingly recognised, and there is every reason to think that they will be welcomed in European countries. One bag of soya beans contains as much protein and oil as four bags of maize, so that one ship loaded with soya beans could carry as much of those essential nutrients as four ships loaded with maize.

The local factories are using the oil for the manufacture of soap. The oil can also be used for several other purposes including cooking and in the manufacture of paint.

A report recently received states that experiments conducted in the U.S. of America have shown that it can at least replace a part of the more expensive linseed oil which is normally used. Exposure tests showed that exterior paints made from blends of soya bean and other oils were as durable and sometimes more durable than straight linseed oil paints. Paint in which 100%

soya bean oil was utilised tested against a similar linseed oil paint for drying, brushing, flowing and other qualities, was considered equal to the linseed paint except for being somewhat slower drying. Panels which received three coats of soya paint remained in good condition after four years exposure to weather. Slow drying oils last longer than quick dryers because they do not harden, crack and break down (due to oxidation) as quickly. Soya bean oil has some good qualities such as freedom from yellowing and elasticity which make it a desirable oil for use in paint. It is thought that it will enter more and more into paint manufacture in future.

In the U.S. of America large quantities of soya bean flour are used in the confectionary trades, and it is also used by the meat packers as a binding agent in sausages.

When the raw beans are ground into meal, and this is stored, the oil it contains oxidises within a few days, and an unpleasant rancid flavour develops. To avoid this it is necessary to grind a fresh supply every two or three days. When maize is mixed with soya bean in the proportion of 5 to 1 respectively and they are gristed together, the rate of oxidation is much slower, and the mixture may be stored for a few weeks before any marked deterioration takes place. The residue which remains after the oil has been extracted can be milled for use as flour. In this form it can be stored for many months. This flour can be mixed with 75% of wheaten flour for making bread, cakes, etc., and it greatly improves their nutritive qualities.

Patent processes for de-hulling and disembittering the beans have been developed in Europe and America and flours and "grits" which retain the greater part of the oil, can now be manufactured, and such processed foods can be stored for several months. They contain 40% to 50% of protein and 20% of fat when the oil is not extracted, down to 1% of fat when the process is designed to remove the fat from the bean meal.

The manufacturers of these patent flours claim that when 20% of soya flour is mixed with wheaten flour for bread-making great improvement in the nutritive value of the bread is obtained, and that such bread will retain its freshness for one day longer than can be obtained without the addition of soya flour.

Other claims for the nutritive qualities of soya beans and their processed flours are as follows:—

The protein in 1 lb. of soya beans is equal to that in 2½ lbs. of beef, or 54 eggs, or nearly two gallons of whole milk.

Soya bean flour, properly prepared, retains practically the full food value of the original bean.

Soya bean flour is rich in minerals, rich in high quality protein, rich in fat, and rich in vitamins.

The most expensive foodstuffs are minerals, vitamins, proteins and fats. Soya beans are rich in these and yet relatively cheap.

Soya beans contain a greater concentration of essential food elements necessary for human consumption than any other common food.

Students of human nutrition assert that calcium is one of the elements that is usually deficient in low cost diets. Soya beans are one of the cheapest vegetable sources of calcium known.

Of all the legumes and grains, soya bean flour has the greatest degree of alkalinity. Thorough study of the carbohydrates has revealed that only 2% is starch.

A large proportion of the processed soya bean flour and grits produced in America is used in the manufacture of specially prepared dog foods, some of which are marketed in sealed tins. The similarity of the soya bean proteins to those of flesh foods has enabled the makers of those preparations to offer an efficient substitute for meat in a convenient form at a comparatively low price.

Soya Beans produce more protein per acre than other food crops. The crops ordinarily grown in this Colony such as maize, kaffir corn, etc., produce large quantities of starchy food materials. Although these are very useful for many purposes, they are not well balanced foods, as they require the addition of proteins and other nutrients. When these other materials have to be purchased they are found to be expensive, and it will usually be more economical to produce them on the farm. The tabulation below shows how soya beans compare with other common farm crops for the production of protein and oil. The protein and oil content given for soya beans is the average amount yielded by nine Hernon strains grown in trials at this Station. The yield of the ground nut is based on a 28 bag per acre crop of nuts which would yield about 1,274 lbs. of kernels.

	Yield per acre lbs.	Crude Protein %	Ether Extract Oil %	Crude Protein per acre. lbs.	Oil per acre. lbs.
Soya Bean	1,000	39.8	17.2	398	172
Maize...	2,400	9.3	4.7	223	113
Wheat...	1,400	11.7	2.0	164	28
Ground Nuts (kernels)	1,274	30.8	47.1	382	600

Experiments in which various crops for utilisation as hay or as silage were compared at this Station, showed that one of the hay types of soya bean produced an average of 506 lbs. of crude protein per acre over a 5-year period. This amount was exceeded by the velvet bean crop only.

The tabulation shows that in spite of heavier total yields both the wheat and the maize crops produce less protein and oil per acre than soya beans. The acre-yield allowed for ground nuts is heavier than that usually obtained. In spite of this, the ground nuts protein production is lower than that of the soya beans,

though the oil is almost four times as much. The ground nuts are considerably more costly to grow and there is greater risk of their being spoiled either in the field or during storage.

Palatability Trials. Although soya beans can be used for industrial purposes, it is thought that higher prices will be obtained for the portion of the crop which is used for human consumption. In order to ascertain their relative merits when cooked, some forty different strains have been subjected to cooking tests. It was found that, although all have a "nutty" texture in contrast to the "mushy" texture found in other varieties of beans, some of the Hernon strains, particularly No. 18, had a larger proportion of "soft" beans than the others, and these are definitely "softer" than P. No. 184 and H. No. 107. Soaking all night was found to reduce the period required for boiling, but even after immersion for 24 hours in unheated water when the room temperature was 58° F., nearly all of the strains were found to contain a proportion of seed which were impervious to "cold" water; P. No. 184 with 3% and Hernon No. 39 with 45% were the extremes in this respect.

Imported edible varieties such as Easy-cook, Herman, Hayto, Mammoth and Rokuson were included in these tests and it was found that they were not in any way superior to P. No. 184 and the Hernon strains.

Boiling Hernon soya beans for various periods was also tried. The beans were pre-soaked for 14 hours. The first water was poured off and cold, salted water was added. About fifteen minutes was required to raise the water to boiling point. After boiling for 1¼ hours the beans were found to be cooked, though still somewhat hard. After two hours' boiling some were still hard while others were soft, and another hour's cooking was required to soften the whole lot. Boiling was continued for another hour and by the end of that time several of the beans had split open owing to their skins becoming detached, thus both appearance and flavour were somewhat impaired.

Fairly large quantities of kaffir beans and haricots are used in this Colony in natives' rations. In certain seasons supplies of the former are insufficient to meet market demands and the difficulty of handling the crop makes the seed of the latter expensive. The merits of soya beans as food and the ease with which the crop can be cultivated suggest that the mines and other employers of native labour may eventually purchase large quantities of them. The chief obstacle to be overcome is the innate prejudice which natives have against any new kind of foodstuff. At this Station little difficulty in breaking down this prejudice was experienced. During the cooking tests several Europeans ate the beans and freely expressed a liking for them. The curiosity of native employees was thus aroused and they were given some to taste. Next about 5% of soya beans were mixed with their ration of Kaffir beans. After the first six weeks the proportion of soyas was gradually increased until at the end of the sixth month the bean ration consisted of soya beans and kaffir beans in equal proportions. A marked change in our native employees attitude towards soya beans is now apparent. Their

prejudice against soya beans has vanished and they now eat them parched or toasted as well as boiled. Seeing that soya beans can be cooked in less time than haricot beans it would seem that employers who wish to introduce the former into their natives' rations would have no difficulty in breaking down any prejudice they might encounter at first if they commenced by mixing a small proportion with the haricot bean ration.

Green Soya Beans as Vegetables.—Soya beans may be used before they are fully ripe. The pods are too fibrous for human consumption so they cannot be used in the way the common garden or kidney bean is used. The immature seeds after their removal from their pods is the part which is eaten. The beans remain in edible condition for about three weeks, and the season can be extended over a period of several weeks by successive sowings. They are ready to use as soon as the seeds reach their full size, and they remain usable until the pods turn yellow and the seeds begin to shrink. The most acceptable period lies between the two extremes, and at this stage the pods are green to greenish-yellow. They may be cooked either before or after shelling, but though cooking facilitates shelling, when they are to be served hot it will usually be found most convenient to shell first. Shelling is made easier by pouring boiling water over the pods and allowing them to soak for about 5 minutes. Then drain off the water and proceed with the shelling. This can be best accomplished by taking each pod between the forefingers and thumbs of both hands, then keeping both thumbs together, snap the pod across the middle on the opposite side and simultaneously squeeze the beans into a receptacle placed to receive them. The shelled beans may then be cooked after adding about one cup of boiling water to a pint of beans, with salt to taste. Cover and cook for ten to fifteen minutes after boiling starts. When cooked, drain and serve with butter, white sauce or in any other manner. These fresh beans have a pleasing bright green colour. Avoid over cooking because it reduces their nutritive value and spoils the flavour. Green soya beans have a nutty texture and do not soften like green peas, unless they are much overcooked.

FODDER VARIETIES

Varieties which produce large quantities of stalks, leaves and seed, but whose seed are unsuited for human consumption, are classified under this head. The isolation and testing of hundreds of strains enabled this Station to issue the varieties named Otoxi and Biltan about eight years ago. These pioneers have proved their value as fodder producers among the farmers of Mashonaland; but, like all the older varieties, they demand immediate attention when the seed crop was ready to harvest. Crosses were made between a non-shattering variety and the older strains, and after much testing four strains were isolated which, in some degree, possess all the desirable characteristics of both parents, with the possible exception that they require a somewhat longer period to reach maturity than Otoxi and Biltan.

These have been distributed to farmers under the names Jubiltan No. 65, Jubiltan No. 67, Jubiltan No. 77 and Jubiltan No. 109.

Although the Jubiltans produce somewhat fewer bags of seed per acre than the new Hernon strains the size of the individual seeds is smaller and the produce of an acre will re-sow about 50% more land than is possible with the yellow-seeded strains. In trials at this Station conducted over a period of five years Jubiltan No. 77 has invariably given the heaviest yield of fodder, but reports from farmers have favoured No. 65. This is probably due to its robust, upright habit of growth. On the other hand No. 77 has finer stems and more numerous branches than No. 65. It also requires two weeks longer to reach maturity and does not shatter its seed so quickly. Farmers who find delayed maturity an advantage should grow No. 77 in preference to other Jubiltan strains.

The chief distinguishing feature of these strains are as follows:—

Jubiltan No. 65.—Erect sturdy habit of growth similar to that of Biltan. Ripens earlier than other Jubiltans but later than Biltan. Its black-coloured seed is larger than that of the other Jubiltans, but smaller than the yellow-seeded Hernons.

Jubiltan No. 67.—Erect habit, branches long and finer than No. 65. Matures earlier than No. 77. Seed-colour black and size small.

Jubiltan No. 77.—Erect habit, branches long, fine and numerous. When the seed crop is heavy the plants assume a semi-procumbent habit. Requires two to three weeks longer to reach maturity than No. 65, and for this reason, when seed production is the object, it must be sown as early in the season as possible. Trials at this Station indicate that it produces heavier crops of fodder than any other variety of soya bean. The seed is black and its size is small.

Jubiltan No. 109.—Erect habit, branches fine and long. Its fodder yield is somewhat less than that of the other strains, though it yields more seed than they. The protein content is 45.9 per cent., which is nearly as high as that of ground nut cake. The individual seeds are small and only 13 lbs. to 19 lbs. per acre are required for sowing. The seed colour varies with its age. New seed is yellow-brown, but the brown colour becomes more pronounced with advancing age or exposure to sunlight.

JUBILTAN SOYA BEANS v. HERNON STRAINS.
Average Yields, etc., in Strain Trials.

		Yields per acre.		Nutrients in seed.					Rate of sowing lbs per acre.	
Strain No.	Growth period, days.	Hay tons.	Seed, lbs.	Protein %	Per acre.	Oil %	Colour.	Seed number in 1 lb. ± 250.	Drills 36" x 3"	Drills 24" x 3"
65	145	3.25	1,100	44.6	491	13.9	Black	3,000	21	32
67	148	3.25	1,000	45.1	451	18.5	Black	4,100	15	22
77	160	3.75	1,100	42.4	466	14.1	Black	4,300	14	21
109	155	2.75	1,200	45.9	551	14.3	Tawny	4,650	13	19

The particulars given in this tabulation are based on data collected before the Hernon strains were established.

Variations occur in different seasons between growth periods, yields, and size of seed as well as the protein and oil content.

Jubiltan Nos. 65, 67 and 77 were included in trials with Hernon strains in the season 1941-42.

The growing season was curtailed owing to lack of rain, and this favoured the Hernons somewhat. All the varieties were allowed to reach maturity before the weight of the seed and stalks was recorded. Jubiltan No. 77 yielded more than any other strain, and if its yield is expressed as 100, then the yields of the others were as follows:—

JUBILTANS.		HERNONS.	
Strain No.	Mature stalks and seed	Strain No.	Mature stalks and seed.
65	72	18	68
67	90	55	80
77	100	107	72

It is seen that the yield of total fodder of some of the Hernons was as high as that of Jubiltan No. 65. Hernon No. 55 has not been included in previous trials and it is as yet too early to affirm that its productive capacity is equal to that of Jubiltan No. 65, but it appears to be nearer to the ideal yellow-seeded fodder, or dual purpose, type than any of the Hernon strains previously established.

Rate of Sowing. Owing to their abundant top-growth as compared with that of the common yellow-seeded kinds, a somewhat lighter seeding may be given, particularly when seed production is the object in view. On fertile land the rows may be spaced 30 inches to 36 inches apart, and the seed dropped 3 inches to 4 inches apart in the rows if the crop is required for seed. For hay production the rows should be closer: from 12 to 24 inches between rows and 2 inches to 3 inches in the rows will be found to be the most economical distances. Broadcasting is less satisfactory than drilling, because the depth of covering cannot be regulated, but if necessity demand this method of sowing, 60 to 80 lbs. seed per acre should be used . Broadcasted crops may be weeded with light spike harrows until the bean plants are 8 inches high, choosing the hotter part of the day for the work, because the stems are then less turgid and not so likely to be snapped off.

Growth above ground is rather slow at first, presumably because the small seeds of these varieties do not provide as much food material as the larger seed of the yellow kinds, combined with their need for the development of a larger root system to

support the larger growth eventually made. This slow initial growth makes it more important to destroy the weeds early in the season in order that the beans may extend their root systems far and wide and successfully compete with later crops of weeds.

Soya bean hay is very high in quality, particularly that which is made from those Jubiltan strains having fine stems and branches when they are cut before the plants are too old. The best quality is obtained when the plants are cut before the seed develops, but the weight of the crop will be greater if the seed is half grown before the plants are cut. During the season just past a patch of Jubiltan No. 77 was cut for hay at the stage when the pods were nearly full-sized but the seeds were still very small. When it was thoroughly dry it was beaten with a flail to separate the leaves and pods from the stalks and samples of both were analysed by the Chief Chemist's Branch. The results of the analysis are shown in the following tabulation which includes an analysis of wheaten bran for comparison.

JUBILTAN SOYA BEAN No. 77.

	Stalks.	Leaves and pods.	*Wheaten bran.
Moisture %	6.92	7.66	11.9
Ash %	4.79	10.16	5.8
Crude Protein %	6.29	16.54	15.4
Fat %	.49	1.98	4.0
Fibre %	44.40	22.91	9.0
Carbohydrates %	37.11	40.75	53.9
Nutritive Ratio	1:13.1	1:4.1	1:4.0
Lime (CaO) %	1.00	2.90	
Potash (K_2O) %	1.57	2.25	
Phosphate (P_2O_5) %	.19	.43	

The soya bean hay consisted of 60% of leaves and immature pods and 40% of stalks. The analyses show that the leaves have a much higher feeding value than the stalks. The high ash content, which consists of several valuable minerals, indicates that this material would be particularly valuable for feeding to young livestock. Although the crude protein in the leaves in higher than that of wheaten bran it cannot be assumed that its nutritive value is equal to that of the bran. Only carefully conducted feeding experiments could settle that point. Nevertheless the analyses indicate that soya bean leaf meal may be found suitable for replacing a part of the wheaten bran normally used in the ration of certain classes of livestock.

* Analysis taken from a U.S. of America bulletin.

Soya bean hay is easier to cure than most other kinds of legume hay. Several farmers have found that their soya bean hay remained unharmed after being exposed to rain for some few days, whilst velvet bean and cowpea hay produced on adjacent land and subjected to the same treatment had been completely ruined. Although soya hay may be discoloured by the rain and its nutritional value reduced, its palatability is not impaired and cattle eat it greedily. Stockmen who have used it over a number of years say they consider it to be as good as lucerne or even better.

Harvesting: The Retention of Seed in the Pods. In addition to their ability to produce heavier crops of fodder and seed, the strains of soya beans recently introduced ore superior to the older kinds by reason of their ability to retain their seed in their pods for several days after the stalks and seeds are ripe enough to harvest. This non-dehiscent or non-shattering characteristic is nearly as important as the yield of seed itself. Climatic conditions both before and after the ripening stage affect the period that will elapse before shattering commences. Showers of rain or even cloudy skies and low temperatures ofter the crop hasthhhh even cloudy skies and low temperatures after the crop has reached maturity will lengthen the period of seed retention. On the other hand, high temperatures, wind, and particularly rain, on a fully mature crop followed by drying wind, all hasten the splitting of the pods and the shattering of the seed. Both the Jubiltan and the Hernon strains retain their seed for from ten to fourteen days after it has reached maturity, but it is advisable to reap the crop and tie in bundles as soon as it is convenient to do so, after the majority of the leaves have fallen. If the bundles are then placed in stooks they can be left in the field for a further period of several days without incurring loss, excepting perhaps for a few beans on the side of the stook which is exposed to the prevailing winds.

SUMMARY.

Strains of soya beans which yield good crops of seed are now available and it would appear that the cultivation of this crop is now economically possible. The heaviest yields of seed are obtained from the Hernon strains, but those who prefer a quick maturing kind should grow Potchefstroom No. 184. The Jubiltan strains are the best for fodder purposes, but the colour of their seed and low oil content makes them less suited for milling.

Rainfall and soil conditions suited to maize are the best for soya beans also. The humus content of the soil should be moderately high for the best results.

When soya beans are grown for the first time it is advisable to introduce the special kind of nitrogen-fixing bacteria which live in nodules on the roots of the plants. Bacteria laden soil can be obtained from the Agricultural Experiment Station, Salisbury, for this purpose.

The heaviest yields are obtained from crops sown early in the season, but later sowings will yield well when the rainy season is an extended one.

Both maize and wheat drills can be used for sowing the crop. The rows may be spaced from 15 inches to 30 inches apart, to suit the types of drills and weeding machinery it is proposed to use. The seed should be sown at intervals of approximately 1½ to 4 inches in the rows, varying inversely with the space between rows Depth of planting should be between one and two inches and on no account exceed three inches.

Harvesting may comence when the seed reaches the hard dough stage. The stalks should preferably be tied in bundles and stooked as soon as they are dry enough. The machines used for threshing maize and wheat can be adjusted for threshing soya beans also.

About five bags per acre can be expected from early sown well attended farm crops, though twice that amount has been obtained from well manured land.

The oil contained in the beans is high in quality and can be used for edible purposes as well as in the manufacture of soap, paint, etc. The proteins can be used as a substitute for animal proteins in the diet of Europeans and natives, as well as farm livestock. The valuable nutrients, protein and oil can be transported and stored more economically in the form of soya beans than is possible as maize, wheat, ground nuts or beef.

Southern Rhodesia Veterinary Report.

DECEMBER, 1947.

General. A considerable improvement in the position with regard to grazing and water has shown a marked increase in the condition of cattle in all areas.

Tick Life. Has increased in all districts, but with the advent of the rains it has been possible to commence seven day interval dipping in all districts.

Diseases. African Coast Fever:

Salisbury District. Another month has passed without any further infection on Highlands farm, and five day interval dipping and hand-dressing has been re-started on the farm.

Melsetter and Chipinga Districts. No cases have occurred on any of the infected farms. Dipping at five day intervals has recommenced, but was being continually interrupted by the rains. Five day interval hand-dressing was carried out.

Anthrax. No outbreaks reported.

Trypanosomiasis. No new centres or cases on existing centres reported.

Lumpy Skin Disease. Only mild isolated cases reported from Gwelo and Fort Victoria districts.

Quarter Evil. Five deaths were reported from five centres and further deaths prevented by inoculation

Stiff Sickness. Reported from most districts.

Epi-Vaginitis. No cases reported.

Foot and Mouth Disease. Chipinga District. An extension occurred in Mutima Reserve and to Musani and Tawona dipping tank areas. It is suspected that infection was carried across the Sabi River from Devuli Ranch by game, large numbers being seen in the area, which is not usually the case. All cattle at these two centres which were already inside the cordon were inoculated by the 12th December.

European occupied farms: Infection was carried to Daisy Hill farm by what means it is not known, but the three farms lying between Daisy Hill and the nearest infection remained free for several weeks afterwards. Excelsior and Deelfontein were infected by two stray cattle from Daisy Hill. Claremont and Papnat also adjoining Daisy Hill became infected, probably by direct contact.

Fort Victoria District. An extension occurred to another section of Devuli Ranch and because the cattle had now improved in condition it was possible to inoculate them. The inoculation was completed on December 31st.

Piroplasmosis. Seventeen cases in all were reported from the five districts.

Anaplasmosis. Twenty-four cases were reported.

Mallein Testing. Twenty-two horses, 12 mules and 15 donkeys were tested with negative results.

Tuberculin Testing. Two bulls, 110 cows and 185 heifers were tested with negative results.

IMPORTATIONS.

Union of South Africa: Bulls (breeding) 12, cows and calves 295, sheep (slaughter) 162, horses and mares 33, donkeys 15.

Northern Rhodesia: Bulls (breeding) 1, horses 2.

Bechuanaland Protectorate: Cattle (slaughter) 100.

EXPORTATIONS.

Portuguese East Africa: Horses 1, oxen (slaughter) 110, pigs (breeding) 6.

Northern Rhodesia: Bulls (breeding) 1, sheep (breeding) 37, pigs (breeding) 1, horses 2, donkeys 29, goats (slaughter) 11.

EXPORTATIONS—MISCELLANEOUS.

In Cold Storage.

Bechuanaland Protectorate: Beef 2,321 lbs., bacon 130 lbs., sausage 179 lbs., fats 812 lbs., offal 134 lbs., pork 110 lbs., brawn 11 lbs., ham 260 lbs.

Northern Rhodesia: Bacon 25,336 lbs., sausage 4,100 lbs., fats 826 lbs., brawn 126 lbs., ham 5,598 lbs.

Belgian Congo: Beef 46,945 lbs., bacon 410 lbs., offal 4,539 lbs., veal 971 lbs., pork 2,794 lbs., poultry 1,093 lbs.

Meat Products from Liebeg's (Rhodesia) Ltd., West Nicholson.

Union of South Africa: Corned beef 190,800 lbs., Vienna sausages 4,815 lbs., Ideal Quick Lunch 12,000 lbs., potted beef 1,813 lbs.

P. D. HUSTON,
Chief Veterinary Surgeon.

JANUARY, 1948.

General. Cattle in all districts continued to improve, but lack of rain during the month in several districts had an adverse effect on the grazing and crops which will probably be felt later on in the season.

Tick Life has increased considerably but is now being coped with by regular dipping.

Diseases. African Coast Fever.

Salisbury District. No cases occurred on the farm Highlands.

Melsetter and Chipinga Districts. No cases on any of the infected farms. The farm Vooruitzecht was removed from quarantine.

Anthrax. One case occurred in Salisbury district in a herd of 111 head. These were inoculated before any further infection developed.

Trypanosomiasis. In Chipinga district on the Eastern Border ten cases were diagnosed.

Lumpy Skin Disease. Only a few cases reported.

Quarter Evil. Only one outbreak recorded.

Epi-Vaginitis. Two herds were treated and one bull destroyed.

Theileriosis. Seven outbreaks were diagnosed with a mortality of forty-three head.

Heart Water was reported from four farms in Essexvale district.

Anaplasmosis. Reported from all districts, mortality 51.

Piroplasmosis. Also reported from all districts with a mortality of 41.

Foot and Mouth Disease. Chipinga District: During the month the following extensions occurred:—Hofstede infected from Papnat, contact occurred at dipping. Grassflats infected by contact from Daisy Hill. Gambadziya infected from Grassflats on which farm these cattle dipped. Wolverdraai infected by allowing 25 head to stray on to Excelsior. Chipinga West and Glendalough were infected by contact with Excelsior. Geluk and Ivory infected by allowing cattle to stray on to Daisy Hill. Ypres infected from Wolverdraai. Topenya Tank. Muwushu Reserve was infected by an illegal movement from Musani tank Mutema Reserve.

Fort Victoria District: Two extensions occurred both due to stray bulls, one to Nyasushanga area, Sabi Reserve, and the other to Mutsinzwa area, Bikita Reserve, these areas have all been cordoned off and the cattle inoculated.

Mallein Testing. Forty-nine horses were tested with negative results at Bulawayo.

Tuberculin Testing. Eleven bulls, 9 cows and 29 heifers were tested and one cow gave a positive reaction and was destroyed.

IMPORTATIONS.

United Kingdom: Bulls (breeding) 1.

Bechuanaland Protectorate: Bulls (slaughter) 16, oxen (slaughter) 242, cows and calves 45 (slaughter).

Union of South Africa: Bulls (breeding 10, cows and calves (breeding) 60, horses and mares 13, geldings 30, pigs (breeding) 2.

EXPORTATIONS.

Northern Rhodesia: Bulls (breeding) 1.

Portuguese East Africa: Oxen (slaughter) 91, cows and calves (slaughter) 10.

Belgian Congo: Pigs (breeding) 12.

Nyasaland: Pigs (breeding) 1.

EXPORTATIONS—MISCELLANEOUS.

In Cold Storage.

Northern Rhodesia: Beef 8,033 lbs., bacon 11,080 lbs , gammon 708 lbs., ham 38 lbs., sausage 3,809 lbs.

Belgian Congo: Goat meat 1,306 lbs., pork 351 lbs., offal 3,027 lbs.

Bechuanaland Protectorate: Beef 2,415 lbs., ham 40 lbs., sausage 50 lbs., pork 37 lbs., offal 200 lbs., dripping 658 lbs., brawn 41 lbs.

Union of South Africa: Sausage casing 3,670 lbs.

Switzerland: Ox gall 1,154 lbs.

Meat Products from Liebeg's (Rhodesia) Ltd., West Nicholson.

Nil

P. D. HUSTON,

Chief Veterinary Surgeon.

Annual Milking Competition 1946 - 1947

The Southern Rhodesian Annual Milking Competition, which has been held for the past sixteen years, is open to all farmers whose herds are tested under the Government Milk Recording Scheme, other than those who supply milk for the fresh milk trade.

This competition is divided into two separate competitions, one based on the highest average quantity of milk produced by the best fifteen cows in the herd, and the second competition on the highest average quantity of butterfat produced by the best fifteen cows in the herd.

Mr. R. le S. Fischer, "Wakefield," Headlands, who is the winner this year of the competition for the highest average quantity of milk produced, is to be congratulated for the very creditable record of 11,249 lbs. of milk per cow, which means that each cow of the fifteen winners in the herd produced just under four gallons of milk daily during the 300 days' milking period—no mean achievement during one of the worst droughts experienced in Rhodesia.

The second and third prize winners in this competition, the Grasslands Experimental Station at Marandellas and Mr. W. S. Mitchell, of Iron Mine Hill, are also to be congratulated upon the very fine records set up.

For the third year running the Grasslands Experimental Station at Marandellas has been the winner of the Butterfat Competition. In this case the very creditable average of 397 lbs. of butterfat was produced by each of the fifteen winners in the herd. In terms of commercial butter, each cow produced just under 480 lbs. during the 300 days' milking period.

The full results of the two competitions are as follows:—

Competition "A." (For the 15 cows with the highest average milk production in a lactation not exceeding 300 days.)

		Lbs.
1st.	R. le S. Fischer, Wakefield, Headlands. Average production of milk per cow	11,249.6
2nd.	Grasslands Experimental Station, Marandellas. Average production of milk per cow	11,014.6
3rd.	W. S. Mitchell, Springs, Iron Mine Hill. Average production of milk per cow	9,564.6

Competition "B." (For the 15 cows with the highest average Butter Fat in a lactation not exceeding 300 days.)

1st.	Grasslands Experimental Station, Marandellas. Average production of butterfat per cow	397.45
2nd.	R. le S. Fischer, Wakefield, Headlands. Average production of butterfat per cow	386.02
3rd.	A. C. de Olano, Blue Waters, Bromley. Average production of butterfat per cow	329.24

HERD AVERAGES, 1946-1947.

These averages are for cows which completed a lectation during the period 1.10.46 to 30.9.47. The records of cows which died or were sold before completing 200 days or which were withdrawn from the test by permission of the Chief Dairy Officer are not included. Averages are not given also for those herds in which the number of cows completing a lactation during this period was less than five.

OFFICIAL HERD AVERAGES 1946-47.

Owners' Name and Addresses.	Breed.	Milk lbs.	B. Fat	B. Fat lbs	Days.	Number of Cows.						
						2 year old.	Junior 3 year.	Senior 3 year.	Junior 4 year.	Senior 4 year.	Mature.	Total.
Jamieson, J., Criterion Farm, Bulawayo... ...	Friesland	11398.2	3.75	428.0	300	4	1	1	—	—	3	9
Meikles Trust, Ltd., Leachdale, Shangani ...	Friesland	10156.8	3.20	325.1	300	—	—	—	—	—	7	7
Sharp, R. R., Whinburn, Redbank	Friesland	8643.8	3.57	308.7	298	6	3	3	1	4	10	27
Mitchell, W. S., Springs, Iron Mine Hill	Friesland	8631.5	3.47	299.3	300	2	—	—	—	—	—	2
Hards, E. J., Churchill Farm, Marandellas ...	Guernsey	6129 2	4.78	293 3	294	—	1	—	—	1	3	5
Huggins, Sir G. M., The Craig, Enterprise ..	Friesland	7271.5	4.02	292.4	300	2	—	—	—	—	—	2
Pascoe, T. C., Crowborough, Salisbury	Friesland	8092.1	3.55	287.3	299	8	3	2	1	3	8	25
Keightley, J. H., Moorfield, Glendale	Jersey	4286.6	5.30	227.0	297	8	—	2	—	—	—	10
Government Expt. Station, Matopos	Red Poll	6210.0	3.61	224.5	276	3	3	1	3	1	12	23

AVERAGE: 7756 7 lbs. Milk
287.10 lbs. B. Fat.
3.70% B. Fat.
294 Days.

Average No. Cows: 12.

SEMI-OFFICIAL HERD AVERAGES—1946-47

Name.	Breed.	Milk lbs.	% B. Fat	B. Fat lbs.	Days	Cows
Jamieson, J., Bulawayo	G. Friesland	10928.2	3.55	388.1	295	29
Grasslands Experimental Station, Marandellas	Friesland	9935.[illegible]	3.60	357.5	294	23
Kabot, D. S., Bulawayo	G. Friesland	9315 5	3.70	344.4	294	45
Parsons, Mrs. M., Bulawayo	G. Friesland	9445 1	3 39	320.4	299	25
Mitchell, W. S., Iron Mine Hill	Friesland	9337.1	3.30	308.5	334	19
Daisyfield Orphanage, Gwelo	G. Friesland	8121.8	3.66	297.4	286	15
Maynard, Lieut.-Colonel C. I F., Melfort	G. Jersey	6685.5	4.42	295.6	295	15
Fischer, R. le S., Headlands	G. Friesland	8564.6	3.45	295.5	289	74
De Olano, A. C., Bromley	G. Friesland	8195.6	3.60	295.3	296	24
Meikles Trust & Investment Co., Ltd., Shangani	Friesland	8564.4	3 41	291.9	294	74
Bickle, A. L., Bulawayo	G. Friesland	7893.9	3.59	283.5	296	75
Tongue, W. E., Bulawayo	G. Friesland	8208.0	3.32	272 3	292	22
Franklin & Son, Umtali	G. Friesland	6624.5	4.10	271.6	290	109
Gibbs, Hon. H V., Bulawayo	G. Friesland	7880.6	3.44	271.6	290	66
Howard, Mrs. L. M. H., Beatrice	G. Guernsey	5968.8	4.52	270.0	284	22
Blighty Dairy, Gwelo	G. Friesland	8499.9	3.12	264.8	285	5
Scutt, W. F. H., Norton	G. Friesland	7265.8	3 64	264.5	290	34
Kew, B. H., Bulawayo	G. Friesland	6968.0	3.78	263.9	294	31
Black, Estate D., Bindura	G. Friesland	6765 9	3.89	263.3	294	21
McLaren, J. R., Gwelo	G Guernsey & Friesland	6450.5	4.07	262.8	281	41
Turnbull, Mrs. M., Bulawayo	G. Friesland	7326.2	3.56	260.7	288	12
Muggleton, F., Umtali	G. Shorthorn	6126 5	4.13	253.4	273	9
Harley, D. A., Beatrice	G Guernsey.	6165 3	4.04	249.6	290	89
Cousins, Thos., Gwelo	G. Friesland	6651.1	3 74	249.0	281	10
Barry, J. H., Umtali	G. Shorthorn & Afrikander	5874.5	4.20	246 8	287	50
Taylor, Estate Mrs. J. G., Bulawayo	G. Friesland	6353.3	3.90	246.6	265	12
Boyd Clark, C., Inyazura	G. Friesland	6757.7	3.56	240 9	276	26
Butler, Ed., Shamva	G. Friesland	6018 3	4.02	240.9	258	7
Fischer H C., Headlands	G. Friesland	6837.6	3 49	238.6	277	38
Gwebi Government Farm, Gwebi	G. Friesland	6877 3	3.45	237.1	263	18
Palmer, Escourt, Penhalonga	G. Friesland & Shorthorn	6154 7	3.84	236.7	260	39

SEMI-OFFICIAL HERD AVERAGES 1946-47 (Continued)

Name	Breed.	Milk lbs.	% B. Fat	B. Fat lbs.	Days	cows
Baxter, J. A., Salisbury	G. Friesland	6366.1	3.71	236.1	279	74
Mungle, J. T., Odzi	G. Friesland	6020.7	3.92	236.0	299	15
Allan; D. A., Salisbury	G. Friesland	6547.6	3.55	232.6	290	38
Green, E. E. C., Bulawayo	G. Friesland	6294.8	3.68	231.7	291	11
Fischer, W. F., Headlands	G. Friesland	6447.8	3.58	230.9	284	92
Stewart & Sons, J. R., Shangani	G. Ayrshire	6009.5	3.83	230.6	271	18
Huddy, D. J., Salisbury	G. Friesland	6547.7	3.51	230.1	276	70
Tapson Trust, Ltd., E., Rusapi	G. Friesland & Ayrshire	6198.7	3.71	230.1	272	107
Clarke, R. Jackson, Gwelo	G. Friesland & Ayrshire	6087.3	3.77	229.6	274	51
Morrisby, F. B., Gwelo	G. Friesland	7015.4	3.26	228.8	288	71
Freeland, P., Gwelo	G. Friesland	6895.2	3.32	228.7	290	71
Everard, Mrs. M., Inyazura	G. Friesland	6137 8	3 68	226.0	270	30
Linton, P., Salisbury	G. Friesland	6015.4	3.74	225.2	287	47
Van Niekerk, Miss I., Inyanga	G. Friesland	6000 9	3.74	224.8	286	8
MacIlwaine, J. N. L., Marandellas	G. Friesland	6222.3	3.60	224.2	288	10
Tredgold, A. M., Bulawayo	G. Red Poll	5702.7	3.93	224.2	290	48
Morant, Commander E. L., Salisbury	G. Friesland & Ayrshire	5886.0	3.80	223.8	293	28
Marshall, C. J., Bulawayo	Aberdeen/Angus	5571.2	4.00	223.0	259	10
Jamieson, A., Patton, Theydon	G. Red Poll	4899.9	4 51	221.0	297	9
Tennent, A. W., Headlands	G. Friesland	5741.3	3.80	218.6	280	53
Pascoe, T. C., Salisbury	G. Friesland	5932.0	3.67	217.6	288	89
Marshall, D. W., Umtali	G. Friesland	6242.8	3.47	216.8	297	16
Rhodesian Corporation Ltd., Norton	G. Friesland	5625.7	3.70	216.5	290	24
Susman & Newfield, Salisbury	G. Friesland & Ayrshire	5917.2	3.62	214.3	292	47
Cary, L. E. O., Trelawney	G. Ayrshire	5595 4	3.83	214.1	289	17
King, D., Concession	G. Friesland	5704.6	3 75	213.8	256	30
Swaine, H., Gwelo	G. Friesland	6295.3	3.39	213.3	300	7
Moorhouse, C., Umtali	G. Shorthorn	4602.9	4.56	209.9	275	9
Cameron, D. L., Fort Victoria	G. Friesland	5831.4	3.59	209.6	276	17
Norvall, K., Bulawayo	G. Friesland & Red Poll	5838 8	3.58	209.3	275	81
Thurlow, J. G., Bindura	G. Friesland & Red Poll	5260.0	3.97	209.1	275	49
Dobson, A. B., Norton	G. Friesland	5339.[illegible]	3 91	208.9	285	9

SEMI-OFFICIAL HERD AVERAGES 1946-47 (Continued)

Picken, J., Iron Mine Hill	G. Friesland	6005 3	3 46	207 6	292	29
Government Experiment Station, Matopos	G. Red Poll	5459.7	3.80	207.2	272	21
Kingston Farm Syn., Bindura	G. Friesland	5200.0	3.97	206.5	251	5
Gebbie, W. N., Salisbury	G. Friesland	5032.6	4 10	206.4	286	41
Morris, G R., Salisbury	G. Friesland & Shorthorn	5417.8	3 80	206.1	274	28
Knill, H., Marandellas	G. Friesland	5448.8	3.75	204.5	273	21
Rutherford, Mrs J F., Marandellas	G. Friesland	5731.0	3 56	204 3	291	12
Huddy, L., Salisbury	G Friesland	5803.0	3.51	204.2	271	58
Huddy, Mrs. M. R. Salisbury	G. Guernsey	5189 8	3.90	202.8	275	48
Jaffe, I., Umtali	G. Friesland	5331.8	3.79	202.3	295	5
Mutambara Mission, Cashel	G. Friesland	5358.3	3.76	201.7	294	16
Morkel, C. F. S., Macheke	G. Friesland	5288 7	3.86	201.3	295	6
Austen, C. A., Que Que	G. Friesland	5729.9	3.50	201.3	289	6
Harrison, Mrs. C., Shamva	G Friesland & Ayrshire	5836.5	3 41	199 0	274	21
Cumming, J., Norton	G. Friesland	5253.2	3 78	198.7	269	50
Thwaites, R., Marandellas	G. Friesland	5009.3	3 97	198.7	266	27
Stead, Mrs. V, Gwelo	G. Friesland	5394.4	3.60	196.2	278	25
Hathaway, N. M., South Marendellas	G. Friesland	5107.3	3.81	194.9	300	23
Dold, J. B, Salisbury	G. Friesland	5665 4	3.43	194 4	285	57
Rogers, Mrs. M., Gwelo	Friesland	5553.1	3 50	194.2	264	29
McLean, J. H., Gwelo	G. Friesland & Ayrshire	4967 2	3.90	194.1	260	89
Reed, Mrs. S Worthington, Gwelo	G. Friesland	5312 2	3.65	194 0	273	23
McLean, L, Gwelo	G. Friesland	5295 1	3.65	193.3	268	28
B S.A. Co.'s Mazoe Citrus Estate, Mazoe	G. Friesland	4968.2	3.75	186.2	296	13
Maunsell, G. M. B., Bromley	G. Friesland	4371 2	4.21	184 3	270	11
Krahner, Mrs. M. M., Banket	G. Friesland	5086.6	3.62	184.2	287	25
Stobart, H, Arcturus	G. Red Poll & Friesland	4184 5	4.40	184.0	272	15
Barrett, N. G, Rusapi	G. Friesland	5077 1	3 62	183.8	296	25
Whitehead, N. W, Bulawayo	G. Red Poll	4707 5	3 88	182.7	291	28
Moore, S., Salisbury	G Friesland	4087.7	4.45	182.1	279	50
Greaves, R. H., Nyamandhlovu	G Friesland	4880 3	3 71	181.3	276	18
Bowen, P. A, Salisbury	G. Red Poll	4528 0	3 97	179.9	263	70
Huggins, Sir G. M., Enterprise	G. Friesland	5004.0	3 59	179.7	272	31
Duff. J. N., Marandellas	G. Friesland	4662.8	3 83	178.8	284	9
Gourlay, C A. G., Umtali	G. Friesland	4409 3	4 04	178.2	287	10
McCay, J U. Bulawayo	G Friesland	5213.3	3.41	178 0	280	36
Ballantyne, R. A. Salisbury	G. Friesland	4936.4	3.59	177.1	283	86
Mitchell, C. F., Essexvale	G Red Poll	4725 6	3.59	177.0	283	23
Anderson, G. R., Gwelo	G. Friesland	5027 3	3.51	176.5	290	52
Coetzee, D. J., Chipinga	G. Friesland	4468 2	3.93	175.6	297	10

SEMI - OFFICIAL HERD AVERAGES 1946-47 (Continued)

Name	Breed.	Milk lbs.	% B. Fat	B. Fat lbs.	Days	Cows
Brereton, Miss N., Gwelo	G. Friesland & Guernsey	4660.7	3.76	175.3	260	34
Timms, P. S., Rusapi	G. Friesland	4607.1	3.80	175.3	286	32
Mitchell, Misses I. and J., Odzi	G. Friesland	4303.1	4.06	175.1	275	15
Green R. J., Bulawayo	G. Friesland	5033.3	3.45	174.0	260	11
Mares, J., Inyanga	G. Common	4037.2	4.30	173.5	278	12
Stanger, E., Rusapi	G. Friesland	4380.2	3.92	172.5	289	25
Valentine, A. F. H., Umtali	G. Friesland & Guernsey	4197.0	4.04	169.7	292	8
Tracey, C. G., Gatooma	G. Friesland	4679.9	3.62	169.6	275	18
Farmer, J. H., Bindura	G. Friesland	4122.2	4.05	166.8	272	20
Lay, H. T., Headlands	G. Friesland	4459.4	3.73	166.4	289	26
Simpson, K. M., Salisbury	G. Red Poll	4079.2	3.97	162.2	264	32
Futter, G. G., Gwelo	G. Friesland & Guernsey	4364.6	3.71	162.1	261	27
Fleming, G. N., Salisbury	G. Red Poll	4128.4	3.92	161.8	290	35
James, Mrs. Y. V. Russell, Golden Valley	G. Friesland	4493.7	3.58	161.1	284	33
Sparrow, C. E., Gwelo	G. Friesland	4842.2	3.36	160.3	295	39
Christo & Wilson, Gwelo	G. Friesland & Ayrshire	4390.9	3.60	159.1	290	41
Harley, Estate A. J., Marandellas	G. Guernsey	3800.3	4.17	158.4	231	12
Salvation Army, Salisbury	G. Ayrshire	3998.7	3.91	156.5	284	33
Ross, J. C., Salisbury	G. Friesland & Ayrshire	3654.4	4.13	151.2	276	22
Miles, B. L., Banket	G. Red Poll	3819.0	3.90	149.0	278	21
Gietzmann, B., Umvuma	G. Friesland	3820.5	2.86	147.5	294	30
Huxham, Mrs. M., Mazoe	G. Friesland	4010.0	3.57	143.3	295	19
Haywood, W. D., Gatooma	G. Guernsey	3575.9	3.97	142.0	288	8
Gebhardt, G. F., Gwelo	G. Red Poll	3476.3	4.00	138.8	270	22
Hards E. J., Marandellas	G. Guernsey	2668.5	4.90	130.6	229	8
Coke Norris, H. A., Umtali	G. Friesland & Red Poll	3983.1	4.12	129.2	275	25
Cross & Sons, Bulawayo	G. Friesland	3825.8	3.32	127.0	282	56
Margesson, B. C. Trelawney	G. Friesland	3295.4	3.80	124.6	280	7
Old Umtali Mission, Umtali	G. Friesland	3299.0	3.70	123.9	288	7
Ford, C. W. S., Sinoia	G. Ayshire	2376.8	4.25	101.2	218	44
Fox, Captain J. H., Salisbury	G. Friesland	3831.6	3.51	99.5	275	7

AVERAGE FOR OFFICIAL AND SEMI-OFFICIALLY RECORDED HERDS.

Average: 5690.2 lb. Milk; 217.4 lbs. B. Fat; 3.82% B. Fat; 282 Days.

Average No. Cows: 24.

SOUTHERN RHODESIA

Locust Invasion, 1932-48.

MONTHLY REPORT No. 185: MARCH, 1948

Red Locust: *Nomadacris septemfasciata Serv.*

No Red Locusts in any stage of development within the Colony were reported.

M. C. MOSSOP,
Chief Entomologist.

Rhodesian Milk Records.

OFFICIAL MILK RECORDS.

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
Matopo Unity	P.B. Red Poll .	Senior 3 year	5955.00	242.40	4.07	300	Govt. Experiment Station, Matopo
Albert Vale Slangisa XI. .. .. (Recalved 7/7/47)	P.B. Friesland ...	Mature	11979.50	457.15	3 82	300	T. C. Pascoe, Crowborough Estate, P.O. Bulawayo.
Albertvale Bokwagen Van N. 6/343 ... ... (Recalved 31/10/47)	P.B. Friesland .	Senior 3 year	7631 50	265 57	3.48	300	

SEMI-OFFICIAL MILK RECORDS.

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
Verandah	G. Friesland .. .	Mature	5395 00	250.21	4.64	300	R. A. Ballantyne, Box 801, Salisbury.
Commando	G. Friesland .	Mature	6795 00	258 82	3.81	300	
Kalulu.	G. Friesland ...	Mature	6888 00	251.51	3.65	270	
Huggins	G. Friesland	Mature	8247.00	397.09	4.81	300	
Nomad...	G. Friesland ..	Mature	9368 00	331 89	3.36	300	
Zoolass III...	G. Shorthorn	Mature	5891.00	256 36	4 35	300	F. J. Barry, Umtasa, Umtali.
Queen II....	G. Shorthorn. .	Mature	6737 40	267 95	3 98	300	
Naartje II.	G. Shorthorn	Mature	6658.80	239 48	3.60	300	
Maid	G. Shorthorn.	Mature	6867 00	254.46	3 71	300	
Joy II....	G. Shorthorn	3 years	5254.00	270 14	5 14	300	J. H. Barry, En Evant, Umtali.
Charter I.	G. Shorthorn. .	3 years	6531.60	259 02	3.97	294	
Molly V.	G. Shorthorn.	Mature	6327.90	299 72	4.75	300	
Charter III	G. Shorthorn	Mature	6703 50	269.12	4.01	269	
Intombie I.	G. Shorthorn	Mature	9013 70	361.54	4 01	300	
Nerina...	G. Shorthorn	Mature	7574 00	309.08	4.08	300	
Mary	G. Shorthorn . .	Mature	7717 10	305.37	3.83	290	
Bridget	G. Shorthorn.	4 years	5538 60	250.47	4.52	280	
Zoolass I.	G. Shorthorn	Mature	5498.90	226.88	4.13	283	

Queen III.	G. Shorthorn... ...	Mature	7492.10	279.38	3.73	261	J. H. Barry, En Avant, P.B. Umtali.
Bluebell	G. Shorthorn... ...	Mature	7142.90	309.00	4.33	300	
Monica	G. Shorthorn... ...	Mature	7935.40	340.58	4.29	300	
Flaky I.	G. Shorthorn... ...	Mature	7718.10	302.61	3.92	300	
Market I..	G. Shorthorn... ..	Mature	6551.70	269.89	4.12	261	
Dongera	G. Friesland	Mature	6230.60	260.38	4.18	254	J. A. Baxter, Box 1368, Salisbury.
Smuts	G. Friesland	3 years	7233.80	273.97	3.79	300	
Clacupar Polands Brandenia	P.B. Friesland ...	3 years	6774 30	233.43	3.44	300	
Ethel	G. Friesland	Mature	6779.30	238.44	3.52	300	
Moscow	G. Friesland	Mature	7459.90	266.02	3.57	272	
Iron	G. Friesland .. .	Mature	7412.30	263.69	3.56	256	
Clacupar Peterine	P.B. Friesland .	Mature	6581.40	245.16	3.73	300	
Picardy	G. Friesland .	4 years	7356.00	243.43	3.31	232	
D.84 (Twin)...	G. Friesland	Mature	8023.00	320.58	4.00	259	A. L. Bickle, Box 595, Bulawayo
Justice I.	G. Friesland	Mature	7640 10	334.64	4.38	264	Estate D. Black, Burnside Farm, Bindura.
Dainty...	G. Friesland	Mature	9157.70	351.73	3.84	300	
Destiny IV....	G. Friesland	Mature	8471.70	321.53	3 80	300	
Destiny I.	G. Friesland	Mature	8687.50	344.51	3.97	300	
Donser I....	G. Friesland	Mature	6846.40	275.89	4.03	267	
Stugwan	G Friesland . ..	Mature	7833.50	276.26	3.14	269	Blighty Dairy, Box 231, Gwelo.
Irene	G. Friesland	Mature	9991.50	305.46	3.06	283	
Spring...	G. Friesland .. .	4 years	8570.50	281.82	3.29	300	
Plate	G. Friesland	4 years	6207.50	282 41	4.55	300	B S.A. Co , Mazoe Citrus Estate, Mazoe.
Bella	G. Friesland .. .	3 years	6795 00	233.54	3.44	300	H. T. Bushney, Box 80, Fort Victoria.
Slice	G. Guernsey .	Mature	7893.00	272.19	3.45	249	E Butler, Woodlands, Shamva.
Esta	G Friesland . .	Mature	7216.00	267.30	3.70	275	
Blackie	P.B. Friesland .	4 years	7127.00	342.03	4.80	300	
Rachael	G. Friesland ..	Mature	6127.00	248.45	4 06	270	
Fresia	G. Ayrshire	2 years	6859 50	252.40	3.68	300	L. E. O. Cary, Clovelly, Trelawney.
Jupiter	G. Ayrshire	3 years	5648.50	270.55	4.79	300	
Marjorie	G. Ayrshire .	Mature	6751.00	245 10	3.63	300	

SEMI-OFFICIAL.—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
Tuesday	G. Ayrshire	Mature	7950.10	305.90	3.85	300	R. J. Clarke, Box 98, Gwelo.
Evie	G. Friesland	Mature	7841.60	255.59	3.26	300	
Clemence	G. Friesland	Mature	9725.50	402.11	4.13	300	
Bloom	G. Ayrshire	Mature	8957.00	285.09	3.18	300	
Annetta V.	G. Friesland	Mature	11838.90	369.87	3.12	300	
Capstick	G. Ayrshire	Mature	6184.10	245.66	3.97	285	
Elizabeth	G. Friesland	4 years	7138 90	248.09	3.48	285	
Miriam	G. Friesland	Mature	6033 80	240.09	3.98	263	
Seven	G. Friesland	4 years	8878.50	312.24	3.52	300	
Strawberry	G. Ayrshire	Mature	6475.40	312.83	4.83	300	
Night Out	G. Ayrshire	3 years	6217.00	261.96	4.21	300	
Hope	G. Friesland	Mature	6142 90	256.97	4.18	300	
Ai-Ass	G. Ayrshire	Mature	6140.40	241.29	3.93	300	
Anne	G. Friesland	3 years	8627.70	306.08	3 55	300	
Beetroot	G. Friesland	3 years	6442.40	239.74	3.72	300	
Emily	G. Friesland	3 years	6263.10	257.07	4.10	300	
Isabel	G. Friesland	Mature	5919.10	237.84	4.02	276	
Midget	G. Friesland	3 years	7177.30	300.65	4.19	300	
One Eye	G. Friesland	Mature	6811 40	270.37	3.97	300	
Sixpence	G. Friesland	Mature	7381.40	298.81	4.05	300	
Jumbo	G. Friesland	Mature	5818 00	234.35	4.03	300	J. Cumming, Hillside, Norton.
London	G. Friesland	Mature	7770.00	260.04	3.36	300	
Wankie	G. Friesland	Mature	8361.00	291.92	3.49	300	
England	G. Friesland	Mature	4885.00	242.69	4.97	272	
Esnati	G. Friesland	Mature	7734.00	297.91	3.85	290	
Speur	G. Friesland	Mature	9152 50	316.30	3.46	300	Daisyfield Orphanage, P.O. Daisyfield.
Araminta	G. Friesland	Mature	12170.00	475.46	3.91	300	A. C. de Olano, Bluewaters, Bromley.
Organdie II.	G. Friesland	Mature	7799.00	288.13	3.69	300	
Praha	G. Friesland	Mature	8480.00	304.75	3.59	300	
Porky No. 1	G. Guernsey	Mature	9441 00	305.07	3.23	300	
Jeanette	G. Friesland	4 years	8582.00	331.58	3 86	300	
Currants	G. Friesland	Mature	10741 00	402.40	3 75	300	
Mafunga III.	G. Friesland	4 years	10880 00	350 87	3.23	300	

Masambetie...	G. Friesland	4 years	5312.30	229.22	4 31	300	A. B Dobson, Endeavour, Norton.
Lady Godiva	G. Friesland .	3 years	7227.80	238.90	3.31	300	
Hitler...	G. Friesland . . .	3 years	4738.30	234.31	4.95	300	
Sadzi	G. Friesland	Mature	6180.60	234.16	3.79	276	
No. 358	G. Guernsey . .	Mature	7756.80	336.81	4 34	269	B. St J. D. Downs, Safago, P.B. Gwelo
No. 1	G. Friesland . .	Mature	7248 60	243.86	3.36	243	J. C. Edwards, Box 11, Eiffel Flats.
No. 269	G. Friesland	Mature	8642.50	317.64	3 68	300	H. C. Fischer, Olivia Farm, Headlands
No. 35	G. Friesland .	Mature	10752.00	381 71	3.55	300	R. le S. Fischer, Wakefield, Headlands.
No. 45	G. Friesland	Mature	10891.00	400.66	3.68	300	
No. 49	G. Friesland . .	Mature	10484.00	352.60	3.36	300	
No. 55	G. Friesland .	4 years	8706.00	301.03	3.46	282	
No. 77	G. Friesland	4 years	10193.00	335.88	3.29	300	
No. 158	G. Friesland	Mature	10654 00	368 87	3.46	300	
No. 161	G. Friesland	Mature	9933 00	356.01	3.58	269	
No. 204	G. Friesland .	2 years	6038.00	232.42	3.85	300	
No. 352	G. Friesland	Mature	7199.50	255.94	3.55	249	W. F. Fischer, Coldstream Dairy, Headlands.
No. 401	G. Friesland	Mature	7894.50	287.34	3.64	300	
No. 403	G. Friesland .	Mature	7348.50	243.79	3.32	242	
No. 452	G. Friesland	Mature	7661.50	289.17	3.77	274	
No. 458	G. Friesland . .	Mature	6813.50	262.31	3.85	300	
No. 495	G. Friesland .	4 years	7050 00	274.91	3.90	284	
No. 521	G. Friesland	3 years	6813.00	240.49	3.53	300	
No. 527	G. Friesland	3 years	6575.00	267.68	4.07	300	
Royal	G. Guernsey	2 years	9773.80	391.03	4.00	300	Messrs G J Franklin & Son, Box 105, Umtali.
Queenie	G. Shorthorn .	2 years	6058.10	315.18	5.20	290	
Suund	G. Shorthorn .	Mature	8906.30	432.12	4.85	275	
Silk	G. Friesland . .	Mature	10470.40	437.15	4.18	300	
Ndongwe..	G. Friesland ..	Mature	7533 50	317.92	4.22	252	
Phoebe	G. Friesland .	Mature	10956.30	448.47	4.09	290	
Penga Penga	G. Friesland	Mature	7901 30	302.76	3.83	300	
Nancy II.	G. Friesland	Mature	9627.40	415.36	4 31	300	
Pump II....	G. Friesland	Mature	7645.60	321 49	4.20	300	
Budzi	G. Friesland	Mature	8599.60	356.39	4.14	300	
Beulah	G. Friesland	4 years	6181.30	251.05	4.06	300	
Jennifer	G. Shorthorn ..	3 years	5316 50	231.67	4.37	300	
Marjorie	G. Shorthorn	4 years	5640.60	251.37	4.46	300	
Claisen	G. Shorthorn	Mature	10506.10	447 22	4.26	300	
Mynhardt	G. Friesland .	Mature	6122.50	243.08	3.87	280	
Daisy Bell	G. Friesland . . .	Mature	8016.60	301.11	3.75	252	

SEMI-OFFICIAL—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
Daisy	G. Friesland	Mature	9268.70	304.26	3.28	300	P. Freeland, Lingfield, Gwelo.
Gundaan	G. Friesland	Mature	7887.60	262.08	3.32	300	
Jackie	G. Friesland	Mature	7769.40	255.66	3.29	283	
Jane	G. Friesland	Mature	6612.60	266.19	4.03	268	
Kanda	G. Friesland	4 years	8984.30	306.67	3.41	300	
Lulu II.	G. Friesland	Mature	8142.10	265.14	3.26	300	
Pansy	G. Friesland	Mature	9262.80	286 23	3.27	300	
Selukwe	G. Friesland	Mature	7060.10	243.68	3.45	300	
Umtali	G. Friesland	Mature	10046.00	316.64	3.15	300	
A. 36	G. Friesland	Mature	7584 40	232 00	3.06	300	
A. 42	G. Friesland	Mature	8905.90	285.10	3.20	300	
No. 428	G. Guernsey	4 years	7340.10	278.20	3.79	300	
No. 432	G. Guernsey	4 years	5597.30	251.21	4.49	300	
Gerry	G. Friesland	Mature	10240.00	329.71	3.21	300	Hon H. V. Gibbs, Bonisa, Redbank, P.B. 52L, Bulawayo.
Kath	G. Friesland	Mature	7591.00	252.41	3.32	266	
Trudy	G. Friesland	3 years	9091.00	301.29	3.31	300	
Val	G. Friesland	Mature	9257.00	305.70	3.30	300	
Ethel	G. Friesland	Mature	8238.00	259.23	3.15	254	
No. 48	G. Friesland	4 years	10920.90	398.02	3.64	300	Grassland Experiment Station, Marandellas.
No. 67	G. Friesland	2 years	8090.20	293.77	3.63	300	
Beau Fighter	G. Friesland	Mature	11366.00	360.08	3.17	300	Gwebi Govt. Farm, P.B. 76B, Salisbury
Gwebi Mosquito	G. Friesland	2 years	6773.00	244 82	3.62	300	
Alma	G. Guernsey	Mature	7583.00	327.76	4.32	251	D. A. Harley, Harleyton, Beatrice.
Beauty	G. Guernsey	4 years	6390 30	254.63	3.98	300	
Bella	G. Guernsey	Mature	7335.70	305.35	4.16	300	
Daisy	G. Friesland	Mature	5971.90	261.27	4.37	300	
Ethel	G. Guernsey	Mature	5830.60	255.32	4.38	295	
Hillary	G. Guernsey	Mature	6318.20	231.08	3 66	252	
Jean	G. Guernsey	Mature	6828.20	276.72	4.05	300	
Lily	G. Guernsey	Mature	6693.10	277.96	4.15	300	
Lucy II.	G. Guernsey	4 years	6978 70	284.60	4.08	300	
Marjorie	G. Guernsey	4 years	6007.70	242.92	4.04	300	
Olive	G. Guernsey	Mature	7654.60	294.11	3.84	300	

Pansy II.	G. Guernsey	3 years	4802.10	239 12	4.98	300	D A. Harley, Harleyton, Beatrice.
Susanna	G. Guernsey	4 years	5561.20	232.22	4.18	300	
Wendy	G. Guernsey	Mature	6651 30	296.79	4.46	300	
Queenie	P.B. Friesland	Mature	8043.00	254.89	3.17	300	Mrs. C. Harrison, Box 58, Shamva.
Biddy	G. Guernsey	4 years	6526 50	304.60	4.67	300	Mrs. L. M. H. Howard, Nengwa Farm, P O Beatrice
Araminta	G. Guernsey	3 years	4983.70	259.46	5.21	253	
Lucy	G. Guernsey	4 years	8847.80	429.93	4 86	300	
Peggy	G. Guernsey	3 years	4603.60	238.98	5.19	300	
Squibbs	G. Guernsey	2 years	4894.40	276.01	5.64	253	
Brenda	G. Friesland	4 years	6747.90	249 96	3.70	300	D. J. Huddy, Box 718, Salisbury.
Annie	G. Guernsey	4 years	5687.00	270.97	4.76	300	Mrs. M. R Huddy, Box 899, Salisbury.
Sue	G. Friesland	Mature	7552 10	275.63	3.65	300	Sir G M Huggins, Box 671, Salisbury.
Rosalind	G. Jersey	Mature	6196.90	285 43	4.64	300	A Patton Jamieson, Dunsappie, Theydon.
Zuzi	G. Red Poll	Mature	4996 40	249.83	5.00	300	
No. 2	G. Friesland	3 years	10689.00	389.20	3.64	300	D S. Kabot, Box 261, Bulawayo.
No. 34	G. Friesland	Mature	8058 00	339.87	4 22	300	
No. 76	G. Friesland	Mature	8249.00	314.72	3.82	300	
Daisy	G Friesland	Mature	8423 00	365.55	4 34	300	Kingston Farm Syndicate, Box 2, Bindura.
Jennifer II.	G. Friesland	3 years	6042.40	228.13	3.78	291	H. A Knill, Mendamu, Marandellas.
Bones	G. Friesland	Mature	6672 50	230.92	3.46	266	P. Linton, Box 898, Salisbury.
Botterman III.	G. Hereford	Mature	6652.80	299.02	4.49	300	
Marandellas II.	G. Friesland	Mature	7759.70	273 95	3.53	300	
Skool	G. Friesland	4 years	7935 50	286 11	3.61	300	
Whinburn Bracken	P.B. Friesland	2 years	6446 50	236.91	3.68	300	J. N. L. MacIlwaine, Box 23, Marandellas.
Mountain II.	G. Friesland	Mature	5853 40	264.99	3.87	300	C. J. Marshall, Box 654, Bulawayo.
Sophy	G. Aber. Angus	4 years	6794 40	318.11	4 68	216	
Margaret Rose of Xmas Gift	P.B. Guernsey	Mature	5782.00	239.26	4 14	300	C. W. Marshall, c/o Standard Bank of S.A., Salisbury.
Zamewe	G. Friesland	Mature	8473.70	311.77	3 68	300	
Clover	G. Friesland	Mature	7918.90	294 52	3.72	300	D. W. Marshall, Box 164, Umtali.

SEMI-OFFICIAL—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner
Ida	P.B. Friesland	2 years	4943 50	230.93	4.67	290	G M. B. Maunsell, Forres. Bromley.
Hazel (14)	G. Jersey	Mature	4876.50	246.78	5.06	284	
Dale	G. Red Poll	3 years	7069.30	276.34	3.91	300	Liet.-Col. C. I. F. Maynard, P.B. 112C., Salisbury.
Estelle	G. Jersey	Mature	9203.70	328.24	3.57	300	
Manuchi	G. Jersey	Mature	5054.70	226.99	4.49	277	
Rosa	G. Jersey	Mature	6441.00	313.34	4.86	300	
Striper I.	G. Jersey/Afri.	Mature	8678.90	426.81	4.92	300	
Milk	G. Ayrshire	Mature	8192.40	317.16	3.87	300	J. H. McLean, Box 161, Gwelo.
Salisbury	G. Friesland	Mature	6311.50	228.96	3.63	300	
Rhona	G. Shorthorn.	Mature	7244.20	856.47	3.54	248	
P. 10/2	P.B. Friesland	4 years	8470.00	305.67	3 61	300	Meikles Trust and Invet. Co., Ltd., Leachdale, Shangani.
P. 7/7	P.B. Friesland	Mature	9309.00	317.53	3.41	300	
P. 25/7	P.B. Friesland	Mature	10121.00	344.97	3.41	300	
P. 1/8	P.B. Friesland	Mature	11067.00	337.66	3.05	300	
G. 4/1	G. Friesland	Mature	11016.00	351.71	3.19	300	
G. 3/2	G. Friesland	4 years	8359.00	294.70	3.53	300	
G. 10/2	G. Friesland	4 years	7959.00	345.55	4.34	300	
G. 11/7	G. Friesland	Mature	8955.00	289.04	3.23	300	
G. 17/7	G. Friesland	Mature	9777.00	324.49	3.32	300	
G. 20/8	G. Friesland	Mature	10837.00	456.80	4.22	300	
Surprise I.A.I.	G. Friesland	3 years	7970.00	292.36	3.67	300	W. S. Mitchell, Springs Farm, Iron Mine Hill.
Dahlia	G. Shorthorn	Mature	4983 80	285.07	5 72	297	C. Moorhouse, Odzi Drift, P.B. 9, Umtali.
Natty	G. Red Poll	Mature	8931.80	318.11	3.56	300	Commander E. L. Morant, Box 741, Salisbury.
Onyx	G. Ayrshire	Mature	6514 60	243.14	3.73	265	
No. 61	G. Friesland	Mature	7578.00	243.94	3.22	300	F. B. Morrisby, Sunnyside, Gwelo.
No. 68	G. Friesland	Mature	7716.00	234.53	3.04	300	
No. 75	G. Friesland	Mature	7937.00	247.93	3.12	300	
Carlton Primrose	P.B. Shorthorn	Mature	5785.00	241.03	4.17	300	F. Muggleton, Steynstroom, P.B. Umtali.
Mota	G. Shorthorn.	Mature	7498 00	364 84	4.87	300	
Grootschuur Ripley	P.B. Shorthorn	Mature	7262.00	298.01	4.10	277	
Very Nice	G. Ayrshire	2 years	6038.00	232.58	3.85	264	

Chabici	G. Friesland	2 years	6005.00	228.22	3.80	271	K. Norvall, P.O. Box 637, Bulawayo.
Betty	G. Friesland	Mature	9267.60	339.94	3 67	300	Escourt Palmer, Ferndale, Penhalonga.
Sally	L.R. Shorthorn	3 years	5726.70	229.07	4 00	266	
Sheila	G. Friesland	Mature	10704.70	348.55	3.25	300	
Stella	G. Shorthorn	Mature	6614.90	249.11	3.77	271	
Flossie	G. Friesland	2 years	6845.30	278.54	4.07	300	Mrs. M. Parsons, Weltevrede, Box 7, Bulawayo.
Maggie	G. Friesland	Mature	10865.00	358.42	3.30	300	
Margaret	G. Friesland	2 years	8924.30	293.26	3.28	300	
Nash	G. Friesland	Mature	15028.50	536.34	3.57	300	
Dish	G. Friesland	Mature	9320.00	307 05	3.29	300	
Maud	G. Friesland	Mature	11615.50	380.03	3.27	300	
Belle	G. Friesland	Mature	9180 50	307.84	3.35	300	T. C. Pascoe, Box 1253, Salisbury.
No. 160	G. Friesland	4 years	6456.50	232.81	3.61	300	
Mauure I.	G. Friesland	Mature	6964.60	323.84	4.65	300	Red Valley Estate, Lushington, Marandellas.
Roberta	G. Friesland	2 years	4982.50	229.78	4.61	279	
Joan	G. Friesland	Mature	7754.00	295.18	3 81	300	Rhodesia Corporation, Ltd., Kent Estate, Norton.
Rena No. 49	G. Friesland	3 years	6884 00	264.56	3.84	300	
Daisy	G. Ayrshire	3 years	4648 90	229.82	4.94	300	J. C. Ross, Box 343, Salisbury.
No. 14 (Harriet)	G. Friesland	4 years	6261 10	246.53	3.94	300	J. R. Rutherford, Box 25, Marandellas.
Jenny	G. Friesland	Mature	5782.30	225 58	3.91	300	
Big	G. Ayrshire	Mature	5351.30	227.11	4.24	300	Salvation Army, Box 14, Salisbury.
Ligina	G. Friesland	4 years	7976 70	284.35	3.56	300	W F H Scutt, Maple Leaf, Norton.
Lioni	G. Friesland	Mature	6178.30	264.70	4.29	300	
Tombe	G. Friesland	2 years	7188.70	247.50	3.44	300	
Tumeyu	G. Friesland	4 years	8917.00	309.73	3.47	300	
Esme	G. Red Poll	Mature	5580 90	234.40	4.20	300	K. M. Simpson, Box 96, Salisbury.
Natalie	G. Friesland	3 years	7116.10	235 92	3.32	300	Mrs. V Stead, Ascot Dairy, Gwelo.
Pollyanthus	G. Friesland	4 years	8859.10	283.16	3.20	300	
Cheeky	G. Shorthorn	Mature	7597 00	249.61	3 29	300	Susman & Newfield, Box 959, Salisbury.
Mary X.	G. Friesland	Mature	6358.00	259.61	4.08	300	

SEMI-OFFICIAL—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner
Black	G. Friesland	Mature	6749.50	253.05	3.75	300	H. Swaine, Box 131, Gwelo.
Judith	G. Friesland	Mature	8634.00	318.12	3.68	300	E. Tapson Trust, Ltd., Lesape Falls, Rusapi.
Julia	G. Ayrshire	Mature	7146.00	250.55	3.51	270	
Spider	G. Friesland	Mature	6389.00	263.81	4.13	292	
Chibi	G. Friesland	Mature	8012.60	263.97	3.29	300	Estate Mrs. J. G. Taylor, Box 55, Selukwe
Joeburg	G. Friesland	Mature	7802 50	337.15	4.32	300	
Macombe (No. 1)	G. Friesland	Mature	7948.10	279.70	3.52	264	
Mandy	G. Friesland	Mature	6906.00	268.14	3.88	300	
Nyamani	G. Friesland	Mature	4726.00	245.47	5.19	266	
Bindura	G. Friesland	Mature	6530.30	266.64	4.08	300	J. G. Thurlow, Atherstone, Bindura.
Glendale	G. Friesland	Mature	6424.20	253.38	3.94	287	
Linah	G. Red Poll	Mature	5379.00	237.07	4.41	300	
Pison II.	G. Red Poll	Mature	5948.90	238 97	4.02	300	
Beans	G. Friesland	Mature	5820.90	228.22	3.92	300	R. Thwaites, Stow, Marandellas.
Market I.	G Friesland	Mature	5902.80	227.33	3.85	274	
Matese II.	G. Friesland	Mature	5964.80	248.84	4.17	261	
Betty	G. Friesland	Mature	9108.20	314.92	3.46	300	Mrs M. Turnbull, Box 479, Bulawayo.
Dainty	G. Friesland	3 years	7429.40	233.36	3.14	300	
Pansy	G. Friesland	Mature	8181.00	300.58	3.69	300	
Salisbury	G. Friesland	3 years	7103.60	256.24	3.61	300	Govt. Farm, Umshandige, Ft. Victoria.

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Editorial

Notes and Comments

FARM MECHANISATION.

An article appears in this issue describing the "Multiple Hitch" used on the Government Farm, Gwebi, to assist the mechanical cultivation of wide-spaced maize, and we wish to repeat the invitation issued to farmers in the March-April number of this journal to send us brief descriptions of their own methods of mechanising maize production, since we are aware that a number have completely mechanised the growing of the crop up to the stage of harvesting.

The soya bean crop was fully mechanised on Gwebi Farm this season. It was sown by a wheat drill, every other funnel being closed, and was reaped by combine harvesters as shown in our frontispiece.

THE COWPEA-GROUND NUT WITCH WEED: ALECTRA VOGEL II.

This root parasite of cowpeas and kaffir beans is increasing in the Colony, and in one district it has become so widespread and serious that farmers have been compelled to change to immune legume hay crops, namely, soya beans, sunn hemp and velvet beans. Its habits of growth are similar to those of the witch weed that attacks maize. The seed will remain viable in the soil for many years, and will only germinate when a host crop is grown thereon. Other hosts are ground nuts and haricot beans.

The methods of control of this parasite are the same as those for the control of the maize witch weed, and it would appear

that the most economical method of dealing with it is to plant as early as possible in the season a crop of cowpeas, and reap this for molassed silage or hay before the parasite matures seed. A season's crop of cowpeas can then be planted during the latter part of January, and also reaped for hay or molassed silage before the parasite matures. Either or both of the trap-crops could, of course, be ploughed under if desired. Saunders' Upright cowpeas would be the most economical variety to use for the purpose, since it is a free seeder and the seed is small. The parasite can also be controlled by pulling the plants before the flowers appear.

Farmers are advised to keep a look out for this parasite in order to prevent its spread. It is easily recognised. It is an erect plant with hairy leaves and stems, and reaches a height of 12 to 18 inches. Usually it has a single stem, but sometimes it is found to become branched from near ground level. The flowers are light yellow in colour, and are found close to the stem on a very short stalk. The underground portions of the plant are orange yellow in colour.

An article on this parasite appeared in the November, 1934, issue of this journal, accompanied by drawings of the plant.

FERTILISING FARM FISH PONDS.

In a pond, fish can be considered livestock that pasture on minute water organisms. These tiny organisms are plants. Countless small animal organisms eat these plants. The animal organisms serve as food for smaller fish, which in turn are food for larger ones. So that by fertilising the plant life the fish ultimately will benefit.

Fertiliser application to a clear pond produces phenomenal results. Within a few days the water will turn a rich deep green or brown. This colour, which is due to great numbers of water plants, may get so dense that little is visible below the water's surface.

Swingle and Smith recommend two types of fertiliser for ponds. One consists of a mixture of 100 lbs. of *6—8—4 and 10 lbs. of nitrate of soda for each acre. The other, which is recommended when 6—8—4 is not available, or when a great quantity of fertiliser is required, is made up of the following for each acre:—

40 lbs. of sulphate of ammonia,
60 lbs. of 16 per cent. superphosphate, and
15 lbs. of finely ground limestone
5 lbs. of muriate of potash.

Each of the above fertiliser combinations and amounts constitute one application. The U.S. Fish and Wildlife Service recommends 100 lbs. of 8—8—4 formula per application. This is the approximate equivalent of 100 lbs. of 6—8—4 plus 10 lbs. of nitrate of soda. The first application should ordinarily be made early in the spring when the weather gets warm. When a depth of 12 ins. can be seen in the water, it's time for a second application. Ponds riled (muddied) by flood waters should not be

* Percentages of N.P.K.

Photo Dr J C F Hopkins

Micro photograph of *Striga gesnerioides* (Willd) Vatke seeds germinating on Cow-pea roots.

fertilised until flood danger is reduced. This is usually late in the spring.

For best results, 6 to 10 applications will be necessary during the growing season every year. Where the overflow is small, less fertiliser will be required than in ponds that have a large amount of water pouring over the spillways.

It's easy to fertilise a pond. If the pond is small, the fertiliser can be distributed by hand. There need be no attempt to put it in the middle of the small pond, because wave action will carry it out.

In large ponds of four or five acres, fertiliser can be spread from a boat.

Where clear water predominates in old ponds, fertilisation will generally show a tremendous improvement in fish growth if followed at the rate prescribed for new ponds. The fish will increase in weight from three to five times.

Old ponds that are always muddy should not be fertilised. Fertiliser is of little benefit in any pond which loses a large amount of water during the growing season. Where fertiliser cannot be used, better fishing can be expected if the pond is drained, the fish removed, and the pond correctly re-stocked.

Barn yard manure is not recommended for any pond. A ton of manure will produce only about 40 lbs. of fish.

Manure, however, is used for clearing water that is temporarily muddy due to wind action, heavy rains or recent construction. A ton to an acre, applied two or three times at three-week intervals, will usually clear the water. A commercial mixture of 75 lbs. of cotton seed meal and 25 lbs. of superphosphate to the acre applied at two- or three-week intervals will also do the job, and, in addition, will stimulate fish production. After the water has cleared, start the regular fertiliser programme.

Weed Control. When Swingle and Smith began their experiments, pond weeds were considered good for the fish. Weeds were valued as a necessity for protecting fry. Experiments exploded these age-old theories.

Weeds are now regarded as pests in the pond the same as in the garden. They occupy space which could be used by fish. They snarl fishing lines. Weeds above water prevent fishing from the bank and hinder effective mosquito control. True, they protect smaller fish from larger ones, but this often leads to over-crowding and stunted fish. It is a mistake to introduce water lilies and other flowering plants; you may sacrifice fish for beauty.

There are three types of weeds—submerged, emergent and floating. Submerged weeds. or those that grow entirely underwater, can be controlled in both old and new ponds by commercial fertiliser. The fertiliser so increases the miscropscopic plant growth that its density makes a shade and prevents growth of submerged weeds. The best fertiliser is the mixture of 100 lbs. 6—8—4 and 10 lbs. of nitrate of soda for each acre per application. This fertilisation should begin while the water is still cold just before the weather begins to warm up in early spring.

Broadcast the fertiliser over the weed-beds. Following the first application, two more are made at two-week intervals. Further applications are made three weeks apart until the weeds become covered with algae or "pond scum."

Afterwards, the stems break and the weeds float to the surface. When large masses of these weeds and scum cover the water, usually during spring and early summer, no additional fertiliser should be applied. At this time the weeds are decaying rapidly; additional fertiliser may cause too rapid decay, which will exhaust all oxygen in the water and eventually suffocate the fish. The decaying plants will release nutrients to the water to promote plankton growth, and in some cases no more fertiliser is required for the remainder of the year. Fertilisation, however, should be resumed when objects can be seen in water 12 inches deep.--("The Farm Quarterly," Spring, 1948.)

REVIEW OF "FIVE HUNDRED VARIETIES OF HERBAGE AND FODDER PLANTS."

(Bulletin No. 39. Published by the Commonwealth Bureau of Pasture and Field Crops, Aberystvyth, Great Britain. Price 15/- from the Central Sales Branch, Commonwealth Agricultural Bureaux, Penglais, Aberystvyth, Great Britain.)

This publication should be of great assistance to the student of Agriculture, and also to the professional officers of the many agricultural departments of the Commonwealth, who may be seeking new varieties or ecotypes of fodder plants for special local conditions. To the latter the second part of the book will be of particular value, since it is an index of reference to varieties that have been made in Herbage Abstracts, Vols. 1 to 17.

The first part, which gives brief data of each variety or local ecotype that has been supplied by Official Correspondents and Specialists in Australia, Canada, Finland, Great Britain, India, Netherlands, New Zealand, Norway, Palestine, Sweden, South and East Africa and Trinidad. As is pointed out in the Introduction to the book, this part exhibits many large gaps in the information supplied, since data were not available for its compiler from such huge areas of the globe as the United States and South America, the U.S.S.R., and the rest of Africa other than South and East Africa. Many of these gaps can be filled in by the aid of Part 2, but many remain to be filled in by later editions of the catalogue that it is proposed to make from time to time in the future. We can look forward to these new editions, but the present book already helps to meet a definite need among agricultural workers in the Commonwealth, and perhaps elsewhere.

It may be helpful to mention one or two items of information gleaned from Southern Rhodesian experience that do not appear to be included in the book. For instance, the great potential value of Pearl Millet (*Pennisetum typhoideum*) as an annual grazing crop does not appear to have been recognised sufficiently, although it is already highly valued for this purpose in the Southern States of the U.S.A., and its popularity is increasing in this Colony.

Sorghum arundinaceum (local name Rhodesian Sudan grass) is an indigenous grass of great potential value as a temporary ley

or permanent pasture, hay and silage crop. It has special value in Southern Rhodesia, as has Napier Fodder (*Pennisetum purpureum*), in that it provides most valuable grazing on dry land in the spring before the arrival of the seasonal rains. Its particular value for temporary leys lies in the fact that it is a free seeder, and that it is so easily established from seed.

It is surprising and interesting to note that in Queensland the grass *Brachiaria dictyoneura* is found to be "not an effective smother for weeds," whereas in Southern Rhodesia it has proved to be one of the most effective weed suppressors amongst our grasses.

Mechanization at Gwebi: The "Multiple Hitch"

By F. P. ORSMOND, Superintendent of the Government Farm, Gwebi.

With a view to speeding up the cultivation of 6 ft. spaced maize and economising labour and power, we decided to construct a "Multiple Hitch," after the lines used some years ago for planting maize by planter, four planters being hitched to this implement.

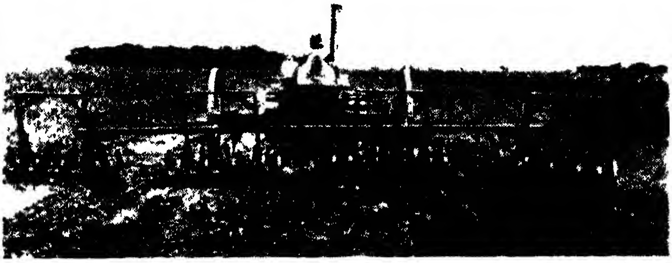
The "Multiple Hitch" was constructed by using the frame and wheels of an old Seed Drill. A piece of 2½in. piping 22 ft. in length was welded to the frame at the back, which was in turn braced with angle iron to the front to form part of the drawbar for this implement.

As the wheels of the drill are 9 ft. apart, it fitted in very well when the tractor was either straddling the rows or working between the rows.

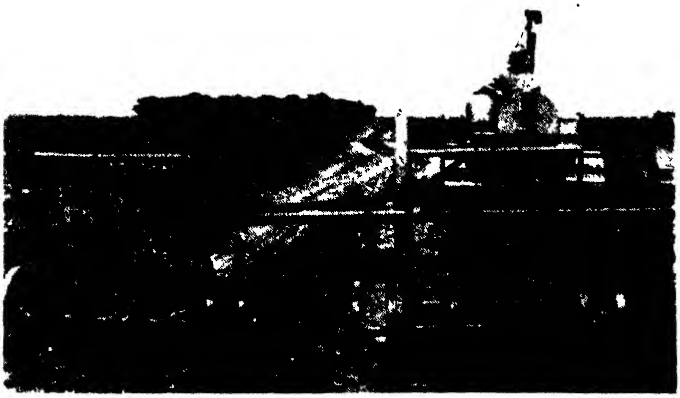
Four single sections of a spring tooth harrow were each extended to a width of 4 ft. 3 ins. by removing the piping to which the spring tine holders are attached. A piece of 1¼ in. piping 4 ft. 3 ins. in length was then drilled to take the original tyres, plus two extra tines on each side outside the harrow frame. Duck foot tines were fitted to all the back holders except the two outside ones on either side. When cultivating very young maize, it has been found necessary to remove these two outside tines, as the young plants are apt to be buried by the earth thrown up.

The four extended harrow sections were now linked together with what may be described as frames constructed of angle-iron forming a complete rectangle suitably braced (see photographs). By making use of holes in the sides of these frames, the four harrow sections were coupled together by means of links made of ⅝ in. round iron rods with hooks and eyes. This was found essential, as on uneven ground the sections were inclined to concertina, and thus rip up odd plants in the line. By coupling them, this trouble was entirely eliminated.

The side members of each frame are perforated with holes, and this allows the height of the links coupling them together to be raised as the maize increases in height, so as to allow the links to clear the maize without damage to the latter.



The complete outfit.



Close-up showing details of linkage.

Combining Soya Beans, Gwebi Farm, 1948. This crop is readily mechanised from planting to harvest.

This implement, with the four extended spring-tooth sections coupled up, has enabled us to do excellent cultivations to 4 ins. in depth. During the course of an ordinary working day 85 acres are cultivated with ease. By being able to cover so much ground in the course of a day, this gives one the opportunity of getting in to one's lands when conditions are most favourable for cultivation, thus avoiding being forced to cultivate when lands are too wet, and so causing possibly irreparable damage to the soil structure.

When hand planting, we attach three 8 ft. disc harrows to the "Multiple Hitch" for pre-cultivation and covering the seed in one operation; this combination covers 100 acres per day. The same set up can be used immediately behind planters. A very good seed-bed is formed in this manner, as well as killing all the young weeds.

Drag harrows may also be attached in multiples; in fact, any implements which lend themselves to being worked in multiples may be hitched to this very useful "Multiple Hitch."

Keeping Farm Records

Good Records mean better Farming

By the Division of Marketing and Agricultural Economics,
New South Wales Department of Agriculture.

In the ordinary business world it is a common occurrence for one man to make, if not a fortune then, at least, a sound and substantial income in a particular line of business, while another man in the same type of business, working under similar conditions and in similar circumstances, goes bankrupt. A farm is one type of business, and, in farming as in other businesses, it is found that some men achieve success while others are continually battling to "keep their heads above water."

Why is this such a common occurrence? There may be several explanations. In some cases it may be just that one man works hard while another is lazy; or perhaps one man has a sound knowledge of the problems and techniques of farming while the other has not; or, again, perhaps one man may be doomed to failure from the start because his farm is infertile or badly situated. Any one of these factors MAY be a cause of failure, but more often than not, none is.

The most common reason for failure in business is a lack of business ability on the part of the manager—the man who has to make the decisions. Often the finest craftsman will fail in a business of his own for that reason. It is frequently overlooked that the majority of farmers in this country have a dual role to play; that is, as well as having to do most of the physical work they are also the managers of their farm businesses as a whole. Now, although it is difficult to prove statistically, it is undoubtedly true that more farming failures are due to a lack of business ability on the part of the farmer than to any other single cause.

Of course, it is not to be denied that the farmer meets with far greater difficulties of management than does the average manufacturer or retailer. The latter does not have to contend with the floods, droughts, hail, frost, insect pests, diseases and such extreme price fluctuations as the farmer frequently encounters. But this merely indicates the complexity of the farm business. Although such factors as have been mentioned are often the underlying causes of the severe losses so often sustained by farmers, it is also true that if a farm is conducted on systematic business lines the adverse effects of a bad season, of successive bad seasons, or of a severe fall in price, can, in most cases, be reduced to such an extent that the farmer is able to continue to stand on his own feet. In addition, many farmers who, for one reason or another, have a farm which returns them a reasonable living in spite of the

fact that their business methods are haphazard and careless, could greatly increase their profits, and consequently their material comforts in life, if they were to pay more attention to the business side of their farming.

No farm and no business can be managed soundly and economically so as to yield the maximum nett profit unless an adequate and reasonably detailed set of records is kept. In the case of the farm business, both financial and production records are desirable if maximum efficiency is to be attained. Records in themselves will not make a farmer a business man, but, probably without exception, a farmer who keeps adequate records and who studies them carefully will increase his business efficiency and consequently his nett profit.

Little Time Required. On first sight it often appears that compilation of the records will take a considerable amount of time. However, this is not the case. It is true that in the early stages, before he is really used to them, they will take much more of the farmer's time than will be the case after he has been keeping them for a few months. Most farmers find that once they are used to keeping records, the work requires less than 10 or 15 minutes of their time per week. Analysing and studying the records at the end of the financial year will take some little time, but it is certainly worth while—it would be impossible to find a more profitable way of utilising a wet day.

How the Records Can Help. In the space of a short article such as this it is impossible to deal in detail with the various uses to which farm records may be put, or, in fact, even to list all of the many uses which can be made of such records. For this reason the list and brief comments which follow are not intended to be complete, but merely aim to illustrate some of the ways in which records will help in the conduct of farm business.

Adequate records will:—

1. Make it possible to ascertain accurately the profit or loss for the year. This is impossible if reliance is placed merely on cheque butts, bank statements and invoices, as is the practice of so many farmers.

2. Enable the farmer to ascertain the return he is obtaining on invested capital, as distinguished from the return obtained for his own labour and management.

3. Enable a comparison of costs from year to year, and, in some circumstances, with other farms. By doing this it will often be possible to evolve ways and means of reducing costs or certain items of cost. At a glance the major cash cost items can be seen, and any disproportionate increase from year to year can be noted.

4. Enable preparation of income tax returns easily and accurately. This in itself probably makes the keeping of records well worth while. Not only are adequate records a legal requirement in so far as income tax returns are concerned, but the keeping of accurate and detailed records will frequently make it possible to save a very considerable amount in taxation.

5. Enable the supply to the local farmers' organisations of a great deal of valuable and authentic information regarding the industry should it be desired. Such information will often prove most valuable to the organisations concerned, and indirectly to the farmer concerned.

6. Provide, over a period of years, a record of prices paid for various requirements and for stock, and a record of prices received for products, as well as a record of the quantities of various items used on the farm and a complete record of production. These details may appear to be of comparatively little value when they are first recorded, but frequent cases have been noted where such information, recorded in definite form, has proved of real value in solving some problem which has arisen, perhaps years later. No matter how good the farmer's memory, he cannot record all the details which might prove unexpectedly valuable in years to come.

7. Over a period of years, enable a farmer to budget with a reasonable degree of accuracy—which cannot be done by reliance on memory. Farm budgeting is an important subject in itself, and it is hoped to devote some space in a future issue to a discussion of this subject.

These are but a few of the uses to which farm records can be put; there are many others. When first keeping records, a farmer will probably not appreciate their full value. It is important to realise that a farm records system will not show up to greatest advantage during the first year or two of its use. It is, perhaps, as a reference in after years that it proves of greatest value, and, consequently, the longer the records are kept, the more valuable they become.

Deep Tillage

By E. W. RUSSELL, Rothamsted Experimental Station.

[Extracted from the "Agricultural Engineering Record," Spring, 1948.]

Deep tillage has been practised in parts of Britain for nearly 200 years on light sands, and for 100 years on heavier soils, although it was a very laborious operation until the introduction of the steam engine to the farm over 80 years ago. Deep tillage has become even easier during the past 20 years with the introduction of large track-laying tractors. In spite of its long history, deep ploughing is still an operation on which different successful farmers, farming on apparently similar soils and following the same general methods of farming, hold diametrically opposed views. It would therefore appear that deep ploughing can be of benefit only under certain conditions, for otherwise it would not be possible for competent farmers to be in disagreement on such an essential part of the technique of cultivation. There is still very little knowledge of just what consequences deep tillage, either subsoiling or deep ploughing, has on a soil or crop, and it was to learn something about the subject that the Agricultural Improvement Council, with the encouragement of the Agricultural Research Council, initiated a series of deep tillage experiments that are being carried out on farms all over the country. These experiments were started in the autumn of 1944, and only slowly can the consequences of the various effects deep tillage has on the general management of arable land be unravelled.

In this article, deep tillage operations are considered as falling into two groups: those that are primarily subsoiling, or the loosening of the subsoil without bringing it to the surface; and those that are primarily deep ploughing, or the inversion of the soil so that much of the subsoil is brought to the surface. In practice, the division is not always quite so clear cut, as on the one hand the design or equipment of the plough can be changed to allow a greater or lesser proportion of the surface soil to be buried deeply, and on the other hand there are implements such as the gyrotiller that can be regarded mainly as subsoilers but are capable of bringing up varying proportions of subsoil to the surface.

Deep tillage has one obvious consequence. The soil is loosened and the number and size of the large pockets of air in the soil are increased. If the base of the loosened layer is impermeable to water, and rain follows the deep tillage before the next crop is able to use much of the water, the air pockets will become full of water, and the soil will be turned into a marsh. Hence, the first point that should always be borne in mind is that deep tillage

must only be practised on drained land. Land with impermeable subsoils, or high water-tables, must never have the subsoil loosened. However, deep tillage, whether subsoiling or deep ploughing, can improve drainage by increasing the size of the air spaces in the soil, provided that the water percolating through the loosened layer can get away into drains or into deep ground water. It is not yet known if subsoiling and deep ploughing are equally effective for this purpose, but it is possible that deep ploughing is the more reliable method of improving the ease of drainage. When the subsoil is dry, subsoiling is probably as efficient as deep ploughing in this respect, but in some years this condition occurs only in summer and under a standing crop. Also, it is possible that on some soils such as silts, where the soil particles run together easily, deep ploughing, by bringing the subsoil to the influence of the sun, mellows it so that the clods when wet do not run together as easily as they did when they were in the subsoil. However, these points of difference between subsoiling and deep ploughing as they affect drainage have not yet been proved by rigorous experiments. Deep tillage can increase the air content of the subsoil, and hence improve the aeration of the soil around the roots of plants. It can also increase the amount of water the soil can hold when it becomes water-logged; but it cannot increase the amount of water a well-drained soil can hold, that is usable by crops. If deep tillage improves the drought resistance of crops, it is for reasons other than this.

Deep ploughing differs from subsoiling in that the surface soil is buried under a layer of subsoil. This has three distinct consequences: surface weeds and weed seeds are buried deep: the deep roots of pernicious perennial weeds, such as dock and thistle, are brought to the surface; and manure, lime, fertilisers, or more fertile friable soils are distributed through a deeper layer.

The power of deep ploughing to control weeds can be remarkable. In all the experiments recently carried out in England, deep ploughing--ploughing, that is, from 4 to 6 ins. more than the customary depth--has never brought up weed seeds, although ploughing that has been only 1 or 2 ins. deeper than usual has brought up many buried seeds. When some strips of land have been ploughed deep and others shallow in autumn, the shallow ploughed strips have sometimes been green in spring while the other strips have always been practically free from weeds, provided that the ploughing has been done well. In several areas the chief difficulty of making a good job of deep ploughing is that the subsoil sticks to the mouldboard. Also, it is difficult to set some multi-farrow ploughs to bury all surface weed seeds and rubbish very deep, because they cannot be set to cut a sufficiently wide furrow for good inversion when they are working deep, although the depth may well be within the capability of the mouldboard. The power of autumn deep ploughing to give cleaner land in the spring can be of very great value if for any reason a farmer is late with his spring work, as was frequently so last year; he is able to prepare the top few inches of surface soil into a seed bed rapidly, without risk of it drying out. An example of the benefit of this extra cleanness of the soil is furnished by deep ploughing experiments at Rothamsted in the spring of 1947. The

land to be sown with sugar-beet was worked quickly and apparently well, and was drilled in late April. However, annual weed seeds germinated with the sugar-beet on plots ploughed 6 ins. deep, while none germinated on those ploughed 12 ins. deep. Although germination was rather slower and not so even on the plots ploughed deep, the beet grew quicker than that of the shallower ploughed plots, even though the latter plots were horse-hoed, singled, and hand-hoed, as early as possible, and at harvest, probably largely in consequence of the freedom from early weeds, the yields of beet on the deep ploughed plots were over 3 tons an acre higher than on the other plots. This greater freedom from weeds often persisted throughout the season, although there always were some fields where the weeds appeared equally serious on all plots and a very few fields where they appeared worse on the deeper ploughed plots. These differences from the usual behaviour, however, were noticed only in the summer and not in the spring.

A second possible consequence of deep ploughing is that it enables nutrients to be incorporated more deeply than when shallow ploughing is practised. This effect is important only when the nutrients cannot move easily in the soil, and therefore applies to lime, potash, phosphate, and farmyard manure, but not to nitrogen. These materials fall into two classes: lime and plant foods. If the subsoil is very acid, the spreading of lime on the soil surface, followed by deep ploughing and a further spreading of lime, will quickly sweeten a much greater depth of soil than if the lime were incorporated in only the top few inches of soil. The advantage of sweetening the soil in this way can be very striking in short periods of drought, for deepening the sweetened layer of soil allows the roots to penetrate more deeply and to take more water from the soil. The depth to which farmyard manure is ploughed-in the soil seems to have no effect on its value to the crop. In the Rothamsted experiments, farmyard manure that was spread on the land in the autumn and then ploughed-in either 6 or 12 ins. deep increased the yield of potatoes and sugar-beet equally for both the deep and the shallow ploughed plots. The responsiveness of the crop to potash and phosphate may depend on the depth to which these nutrients are ploughed-in. It would be thought that deep incorporation of these fertilisers would benefit during dry periods those crops, such as sugar-beet, that grow fast in mid-summer, for plant roots can only extract their food from moist soil, and during a dry period the crop tends to dry the soil from the surface downwards. Hence the deeper the fertiliser is placed in the soil, the longer it will remain moist and the longer it will be available to the growing crop. If this is correct, it would be expected that the poorer the subsoil the more desirable it would be to plough the soil deep, in order to bury the nutrients in the subsoil and make it possible for the poor soil brought up to be enriched. Yet these are the very soils that many farmers, who practise deep ploughing, suggest should not be ploughed deep, or, at least, should be increased in depth only slowly year by year.

The experimental results so far obtained are not yet numerous enough to be conclusive, but they suggest that yields of sugar-

beet can be increased if potash and phosphate are applied in the autumn instead of the spring, and the land then ploughed between 6 and 9 ins. deep. In 1946, autumn ploughing-in of fertilisers on some soils increased the yield of beet by a ton an acre, which is not a poor reward to receive for the extra trouble of having to drill potash and phosphate in the autumn, and nitrogen in the spring. However, on land ploughed to 12 ins. or more in depth the results have been much more erratic, possibly because not enough care had been taken to ensure that adequate quantities of fertiliser were added to the seed bed, which was composed mainly of weathered subsoil, to overcome the harmful effects of its poverty. There is some evidence that on land with a poor subsoil, crops will respond more profitably to large amounts of phosphate and potash if the soil has been ploughed deep, provided the fertiliser is given in two dressings, one before and one after the ploughing.

CONCLUSIONS.

Deep tillage should only be practised on drained land. If the field has a drainage system already installed, or has a naturally free-draining subsoil, deep tillage will often increase the speed of drainage. There is an indication not yet well established that deep ploughing is rather more efficient than subsoiling for this purpose.

Deep ploughing usually gives a better control of weeds in the early part of the growing season, and in consequence may allow spring-sown crops to be planted earlier with less loss of water from the seed bed than is possible on shallow ploughed land.

Deep ploughing enables the depth of fertile soil to be increased. It has not yet been possible to demonstrate rigorously under what conditions this extra depth results in increased yield.

Provided that adequate fertiliser is added to the seed bed to ensure that it is not too poor, that the field is well drained, and that the subsoil does not consist of broken pieces of limestone or large lumps of solid chalk, there is no indication that deep ploughing will depress crop yields no matter what kind of sand or clay is brought up. It is not therefore a dangerous operation under the conditions specified.

Farm Planning

By K. J. MACKENZIE, Senior Extension Officer.

Farm planning presents such a wide field that it would take far more space than we have at our disposal to deal fully with the subject.

It is proposed, therefore, to discuss briefly the more important aspects of the subject in an attempt to guard against the more common errors which are so costly to remedy at a later date. Where a virgin farm is being dealt with, the planning is simple, and more direct than in the case of a farm which has been occupied for some time, and one has a freer hand, and, therefore, a better chance of producing a sound scheme.

Where an old farm is being dealt with, it is wise to ignore all existing land use, to keep an open mind, to treat each land on its merits, and deal with the farm as if it were virgin land.

Do not accept without question that if land is being cultivated it is necessarily arable land. It might make much better grazing than arable or *vice versa.*

The aim should be to work out an ideal plan, and then consider how much of it is practicable from an economic point of view in consultation with the farmer.

It should be noted that it is seldom essential to put the complete plan into operation immediately. Part of it will, of course, be immediately applicable, but some of it must of necessity be deferred over a period of years before the whole complete scheme comes into effect.

The main thing is to *have* a comprehensive *written* plan on which the general policy of production and development can be based, and to *abide* by the plan until developments show that some modifications or additions are warranted.

General Policy will depend on a great many factors which cannot be controlled, such as climate, distance from market, size of the farm, and capital available, but basically the capability of the land itself will be the main ruling factor, since all revenue produced must come from this land. Here, then, we have a definite indication as to what the first step should be. Obviously a careful survey of the land itself to ascertain the best *use* that the various types of land can be put to.

In United States of America, where land-use planning has been put into effect on over 96 million acres, it has been worked out that land should be divided into eight classes, according to soil type, erodibility, land slope, extent of existing erosion, etc., and certain specific rules are laid down for the treatment for each class of land.

The first step, then, is the preparation of a land capability map showing how much land there is of each type, and where it is situated.

Colours are usually employed, to indicate the land classes, and numbers or other symbols the slope, soil type, and degree of erosion.

It will be appreciated here that if these land classes are to be correctly shown on the map, a *survey* of some kind must be carried out. As extreme accuracy is not essential, probably a walking traverse with compass would be the most expeditious form of survey, but a plane table might also be used under suitable conditions.

Basic maps from aerial photographs could be made to show the farm outline, and the main topographical features, provided these could be quickly produced to a standard scale.

Classes of Land. The eight classes of land in common use in U.S.A. planning have the following characteristics:--

Class 1. Very good arable land with slopes up to 1-75 that can be safely cultivated with nothing more than good farming practice might need storm draining and some contouring, and possibly fertilising and green cropping, but little else. Little or no apparent erosion.

Class 2. Good land with slopes between 1-50 and 1-75 that can safely be cultivated with simple, easily applied practices such as storm draining, contouring or strip cropping and contour cultivation, with usual crop rotations and fertilisation.

Class 3. Moderately good land, but steeper than 1-50, and less than 1-30. Some minor gullying and fairly extensive sheet erosion, and can only be permanently cultivated with intensive practices such as storm draining, contour ridging and strip and contour cultivation, fertilising and gully filling and regular biennial green cropping.

Class 4. Fairly good land unsuited for permanent cultivation; best suited for pasture or hay, but can be cultivated occasionally, say, 1 year in 5 with intensive practices to prevent wash. Variable uneven slopes, gravelly or clayey soil, with uneven moisture content or depth, irregular shaped lands interrupted by rock or rubble outcrops, but bearing a good grass cover.

Class 5. Grazing and/or forestry only, with slight or no limitations beyond rotational grazing, and possibly stream bank protection. Good grass cover and reasonable slopes, but unsuitable for cultivation for various causes, such as being too low-lying or too shallow, wrong soil type or too low in fertility, but still good hay land.

Class 6. Suited for grazing or forestry, but careful management necessary to prevent deterioration of cover and erosion. Slopes are fairly steep and are incapable of being mowed. Rotational and seasonal grazing will be required, and careful control of burning. Steep valleys over 1 in 40 liable to gully will fall into this class, and stony hillsides with sparse cover.

Class 7. Very steep, critical slopes with poor cover with probably extensive gullying and wash. Rotational and seasonal grazing and controlled burning will be essential. More suitable for forestry than anything else, but may be grazed with strict limitations.

Possibly extensive gully control work will be essential, which will entail fencing.

Class 8. Steep, rough and stony or rocky, suited only for wild life or recreation. Very sparse cover and extensive sheet and gully erosion. Little use for forestry due to lack of soil depth. Granite kopjes fall into this class.

Land Capability Map. Having completed the land capability map according to the land classes given above, the next step is to re-examine each area of land with the farmer studying each field, and detailing the various protective measures necessary in each case.

Present land use is compared with the map to see what the suggested land use *should* be, and arrangements made to move fences, roads, etc., to conform with new boundaries. The farmer tells the Conservation Officer what livestock he has, what he grows, and where he sells it, what machinery he has, and together they work out a comprehensive plan of action for the whole farm.

The Conservation Officer points out what should be done on every pasture, field and woodlet, to keep the land productive, and protect it from erosion.

Fences and farm roads may need to be changed so they follow the contours, and fit in with contour farming.

Field boundaries will have to be changed so that each field will have mainly one class of land. Some lands will have to be planted to pasture or woodland. Some idle land may be brought into cultivation by drainage or irrigation or clearing of bush and trees

Usually cropland is first selected, then land for feed for livestock, and crop rotations are worked out for these fields, which will all usually come under Classes 1, 2 or 3. Class 4 will generally be used for permanent meadow or hay, and would only be cultivated to re-establish it to pasture or for a special catch crop in emergency.

Farmer and technician, in this case the Conservation Officer, agree on the erosion control practices to be used on each field which will include everything from simple good farming practices to contours and storm drains, strips and possibly sub-soiling, and in some cases draining.

If dams are required, the sites are examined and selected, waterways are chosen and marked off, and suitable practices decided on to keep them from gullying.

When all details have been agreed upon, they are put down in a *written* plan, which includes a simple farm map: this is known as a co-operative agreement, and is signed by the farmer and the Conservation Officer.

The farmer then is ready to go ahead with implementing all the details of the plan. This method of working out conservation farm plans according to the capacity and needs of the land is the only practical approach to the problem. Farmers should like this co-operative method, they should understand it, and it makes *them* the final judges as to what is to be done.

Many other problems will arise, such as the best position for the homestead, or the farm compound, dip tanks, boreholes or wells, but these are incidental, and can be readily solved if the *capability of the land* is made the ruling factor.

This kind of planning is done on the land itself where the problems are. Each field is carefully studied, then the farm as a whole is studied, and the result should be sound land use, and effective land protection.

Conservation farm plans fit the land, fit the farm, and suit the farmer.

Common Errors. Some of the common errors in farm planning are listed below to indicate what can be done to avoid these mistakes:—

Ploughing Through Hollows. Try and avoid ploughing the natural hollows, as all the storm water concentrates in such hollows and they are the only safe outlets for all the storm water on the farm.

By ploughing through them you destroy your only chance of getting rid of storm water safely, and run a grave risk of starting gullies, which will impair, and eventually destroy, all the water supplies on the farm.

Black Vleis. Beware of cultivating black vleis in the higher rainfall areas, particularly in red soil areas, as they are usually too wet to produce good crops, and are difficult or impossible to drain. Rather keep them as first-class grazing than try to convert them into indifferent arable lands.

Stumping. When stumping new lands, make quite sure, by means of test holes, that, first, the soil is well drained and is good and deep enough to justify the cost of stumping, and, second, that you stump square to the fall of the ground. Diamond-shaped lands stumped out at an *angle* up and down the slope instead of straight across the slope, and straight up and down the slope, are difficult to plough, and nearly impossible to protect.

Land Slope. Lands steeper than 1-30 cost twice or three times as much to contour as easy-sloping lands, and the maintenance is in the same ratio; so avoid breaking out new lands which are too steep.

A rough estimate of land slope can be made by sighting straight up-hill and marking the point where a level line of sight strikes the ground. Measure from where you were standing to this point in feet, and divide by five to get the fall or rise on the ground. If the distance be 150 feet, the slope is 1 in 30, and so on.

Roads. Keep your roads on the watersheds as far as possible, even if it means a considerable detour. You will find it easy to maintain roads which can be drained to either side into the grass without the need for storm-water drains.

Establish permanent stock roads on contour or on watershed to and from dips, water supplies and grazing areas, and avoid indiscriminate driving of stock all over the farm.

Water Supplies. If possible, fence off all water holes and drinking places, and pipe the water out into troughs. Dams and water holes, unless fenced off, become breeding places for all kinds of diseases and intestinal parasites; besides, the tramping not only befouls the water, but often forms the initial drop which eventually becomes a gully.

Fencing. The importance of fencing cannot be over-stressed. It is a definite fact that the capacity of a certain area can be doubled by sub-dividing it into four or more camps. Stock tramp out as much or more than they can eat, and do not settle down to graze unless they are confined to smallish camps. Large camps lead to selective grazing, the good sweet grasses being grazed so short that they cannot compete with the less palatable sour grasses which are left ungrazed.

It is better to camp and fully graze only a portion of the farm (thus keeping the pasture short and sweet) than to lightly graze the whole farm.

Fence from the inside out, rather than ring fence the whole farm, and have no funds for camping.

Homestead. While it is desirable to have a good house as soon as possible, it is much safer to postpone the building of a permanent home until a year has been spent on the farm, unless water or boreholes limit the choice to one spot only. Many good farms have been spoilt by a badly sited homestead.

Health is the most important factor to be considered. Build high and be prepared to pump your water rather than build low down and run the risk of malaria.

Choose a site to leeward of the homestead for farm buildings and compound, a site where there will be plenty of room for expansion, and build to a definite well-thought-out plan. Haphazard, unplanned buildings are ugly, inconvenient and expensive.

Choose a simple roof span of 15 to 18 ft. and build in the form of an L or H or a U, with simple gable ends, as this type of building can be added to at any time on any of the gable ends, and needs only 10-ft. iron or asbestos roofing and a simple rafter of uniform size with no beams longer than about 10 feet.

Work Book. Keep a work book in addition to your co-operative agreement, and note down all pending jobs in order of importance so that when normal farm work is up-to-date your labour can be used on useful development.

Lastly. There is a steady drain of fertility on unprotected lands. Don't be misled by the fact that the run-off is small on new lands; this increases each year, and normally all lands over 1 in 100 need protection of some kind.

Make sure of your storm drains, and see that they are adequate.

For sustained high yield, contour, fertilise, green crop and rotate, and results will be assured.

A Suggestion for the Control of Tobacco Witchweed
(Striga gesnerioides (Willd.) Vatke)
by Leguminous Trap-Crops

By H. WILD, Ph.D., D.I.C., Branch of Botany and Plant Pathology.

Introduction. *Striga gesnerioides* (Willd.) Vatke, which has been known in the past in Southern Rhodesia under its synonym *Striga orobanchoides* Benth., is a fairly common indigenous plant in Rhodesia as a parasite on a number of wild legumes and other plants. It is not confined to Southern Rhodesia, but occurs also in Western India and most parts of Africa. Until fairly recently it was not looked upon as being of any economic importance, but a few years ago Brain (1938) recorded its occurrence on Virginia tobacco in the Enkeldoorn district; although the infestation was apparently only a minor one. Since that date, however, the parasite has developed as a serious pest of tobacco on a number of farms in the Featherstone district, which is not far away from Enkeldoorn. So far no other areas have become seriously affected, although occasional plants have been noticed on tobacco in the Hartley and Odzi districts.

Taking into consideration the wide distribution of the plant on indigenous hosts in the veld it is obvious that it might spread to all the tobacco growing districts, and offer a serious threat to the Rhodesian tobacco grower. Two years ago, therefore, the present writer, Wild (1946) drew attention to the pest in order to enable tobacco farmers to recognise it on its first appearance, and so allow them to take early steps to remove the plants before seeding, and prevent its spead. At the same time it was realised that since the *Striga* was capable of growing on various indigenous hosts, as well as tobacco, it might be possible to develop a trap crop which could be rotated with tobacco, and so assist in its control. The principal purpose of this paper is to describe experiments designed to this end.

Description of the Parasite and its mode of attack. Like the mealie witchweed (*Striga asiatica* O. Kuntze), the seed of tobacco witchweed germinates under the stimulus of exudations from the root of its future host, and its radicle penetrates this host root, proceeds to absorb nutrients from it, and so enables it to develop into an adult plant at the expense of this host. The fully-grown plant is attached to the host-root by means of a tuberous swelling of about ½ inch in diameter from which arise a number of shoots about one foot in height and usually within one foot of the main stem of the host in the case of tobacco.

Striga gesnerioides (Willd.) Vatke shoots showing attachment to a host root.

The aerial parts of the stem are usually branched at, or just below, ground level. These branches arise almost vertically and so are closely clustered. The leaves are opposite or alternate on the same plant, are rather scale-like, lie close to the stem; and may be anything up to ½ inch in length. The flowers arise in a rather crowded spike at the stem apex, but the internodes lengthen as the flowers mature. The flowers are in sessile pairs in the axils of the upper leaves or bracts and are somewhat two-lipped, the upper lip being divided into two, and the lower into three lobes, the whole being about ⅓ inch in diameter. (See drawing.)

When found on indigenous hosts the stems and leaves are characteristically dull purple in colour, with the flower a bright purple. On tobacco, however, the stems and leaves are pale green with sometimes a faint purple tinge. The flowers are also a somewhat paler purple and plants with white flowers are sometimes found. The number of individual *Striga* plants on indigenous hosts is usually one only and the number of branches up to a dozen but mostly less. On tobacco the number of individual plants and branches is often much greater, as many as thirty stems per host being quite common.

No harmful effects are visible as a rule on indigenous hosts, but parasitised tobacco shows an increased tendency to wilting and the leaves turn yellow prematurely

On virgin land in the Featherstone district only a few tobacco plants are attacked, presumably by seeds lying dormant which have been distributed by mature *Striga* plants occurring naturally on indigenous hosts As successive crops are grown, however, a heavy concentration is rapidly built up and by the time three tobacco crops have been grown the infestation is so heavy and widespread that the value of the tobacco is seriously reduced. This rate of spread is not surprising, as each plant is capable of producing a very large number of minute seeds.

The Indigenous Hosts of the Parasite. "The Flora of Tropical Africa" gives the following lists of host plants of the parasite, compiled from collectors' notes:—

Indigofera sp., and other Leguminosae.
Ipomoea sp.
Euphorbia abyssinica, Gmel.
Sansevieria sp.

In addition, the authorities of the Kew Herbarium have supplied the following list of hosts compiled from collectors' notes on specimens in their possession:—

Tephrosia spp.
Indigofera sp.
Bergia decumbens, Planch.
Setaria homonyma, Chiov.

In the field, however, the parasite is frequently attached to host roots at some distance from the main stem, other plants may occur in between, and unless the root system of the host is care-

fully traced mistakes are easily made. In consequence, it is possible that some of these hosts may have been given in error. It was found that mistakes can best be avoided by carefully digging and washing away the soil in the neighbourhood of the root being followed by means of a stirrup pump until the connection between the host and parasite can be seen with certainty.

The following is a list of herbarium specimens in the Government Herbarium, Salisbury, of host plants showing the attachment of *Striga gesnerioides* to their roots:

Tephrosia sp., J. C. Hopkins in G.H. No. 14555.

Tephrosia pseudolongipes, Bak. f., H. Wild in G.H. No. 14610.

Indigofera confusa, Prain & Bak. f., H. Wild in G.H. No. 14611.

It will be seen that these latter are all legumes, as well as some of the other records quoted, and therefore it was borne in mind that in the search for possible trap crops it would be well to concentrate on this family. These species themselves were unlikely to prove of value as they are all small, woody perennials, which would probably require a good deal of selection before they would respond satisfactorily to cultivation.

The Investigation of Possible Trap Crops. In the 1945-46 season two farmers of the Featherstone district laid out field trials in which various Leguminous and Solanaceous plants were sown on land known to be badly infested with the parasite, in the hope that *Striga* plants would appear on one or other of them, and so suggest a suitable trap crop. The Solanaceous crops were included as being related to tobacco, and so also stood a chance of being parasitised by the witchweed.

The plants tested in this way were:—

Virginia Tobacco.

Tomato.

Cape Gooseberry (*Physalis peruviana*, L.).

Cow Pea (*Vigna unguiculata* (L.), Walp.).

Sunn-hemp (*Crotalaria juncea*, L.).

Ground Nut (*Arachis hypogaea*, L.).

Garden Pea (*Pisum sativum*, L.).

Velvet Bean (*Mucuna deeringiana* (Bort.), Holland).

Unfortunately, the planting season was a dry one and germination was poor. The tobacco in particular germinated badly when sown directly in the field and produced no *Striga* plants. The only plant that responded at all was the tomato. One witchweed plant developed on this host. The tomato, however, is hardly suitable as a field crop under Rhodesian conditions unless irrigated, and so these preliminary results were somewhat disappointing.

When it was realised that field trials of this type were likely to be unreliable, and take a long time to produce satisfactory results, it was decided that the method devised by Brown and

Edwards (1944) for observing under laboratory conditions the effect of a host stimulus on the germination of the seeds of the mealie witchweed might be modified to test whether any of a range of Leguminous, Solanaceous, and Graminaceous crops were capable of inducing the germination of the seeds of the tobacco witchweed.

In the first place *Striga* seed about 6 months old, taken from a plant parasitic on tobacco were sprinkled over moist filter paper in a Petri Dish and tobacco seed added. In the course of three or four weeks the tobacco seed had germinated readily enough when incubated, but no germination of the *Striga* seed was observed.

Apparatus was then set up on the lines suggested by Brown and Edwards (1944), and their pretreatment method followed. This technique involves scattering the *Striga* seeds fairly closely over the surface of a sheet of blotting paper, which is then inserted in a glass cylinder, open at both ends, so that the seeds lie between the paper and the glass surface. These cylinders are then stood vertically in Petri Dishes with water and placed in an incubator in the dark at 22°C for approximately three weeks. This is the pretreatment period and allows the seed to absorb moisture, and probably undergo certain chemical changes which prepare it for germination once the host stimulus is applied. This is done by placing host seeds along the upper rim of the cylinder in a groove formed by drawing the wet filter paper away from the glass and replacing the cylinders in their dishes in an incubator at a somewhat higher temperature In these experiments the temperature of this second incubator was 30°C. The host seeds germinate and their roots pass vertically downward between the glass and the filter paper into the water in the Petri Dish. At intervals the *Striga* seed can then be examined microscopically to see whether they have germinated. In the case of Leguminous seeds it was found necessary to soak them in water at 30°C for 24 hours, in order to speed up, and render more uniform, their rate of germination.

An assumption was, of course, made that the tobacco witchweed would behave in the same way as the mealie witchweed under these conditions, although no evidence existed that it would do so except the close botanical relationship and mode of life of the two plants. In the event this assumption proved justified.

Experimental Results.

Exp. 1. On 18th December, 1947, an experiment was set up, on the lines described, in which the seeds of nine different crops with tobacco as a control were tested to see if they were capable of inducing the germination of tobacco witchweed seed. The witchweed seed was by this time approximately one year old. Pretreatment at 22°C began on 18th December and ended on 8th January, 1948, then incubation with the host seeds continued at 30°C for twelve days.

The following is a list of the seeds tested:-

1. Cow Pea (local hybrid of the New Era variety) (*Vigna unguiculata* (L.), Walp.).
2. *Indigofera hirsuta*, L.
3. Sunn Hemp (*Crotalaria juncea*, L.).
4. *Tephrosia vogelii*, Hook. f.
5. Soya Bean (*Glycine max* (L.,) Merril.).
6. *Sesbania cinerascens*, Welw.
7. Cape Gooseberry (*Physalis peruviana*, L.).
8. Kaffir Corn (*Sorghum vulgare*, Pers.).
9. Munga (*Pennisetum typhoides*, Stapf & Hubbard).
10. Virginia Tobacco.

Numbers 2, 4 and 6 in this list are species indigenous to Rhodesia tested in the past as possible green manure crops at the Salisbury Agricultural Experimental Station.

The tobacco control gave a germination of approximately 30 per cent. of the witchweed seed within 2 millimetres of a host root whilst the cow-pea gave a germination of approximately 40 per cent. None of the other species tested induced any witchweed germination whatever, except *Tephrosia vogelii*, but here only two seeds germinated.

Exp. II. As only leguminous seeds had produced any response in Exp. I., Exp. II. was confined to leguminous seeds, and as the variety of cow-pea previously tested is not widely grown in Southern Rhodesia at present this was included once more as a control, but with three other varieties in addition which are either widely grown or are recommended by the Agricultural Experimental Station, Salisbury.

Pretreatment began at 22°C on 12th March, 1918, and ended on 8th April. Host seeds were added on this day and incubation at 30°C continued until 15th April. The percentage germination was calculated by taking random microsope fields with a host root as central axis. This gave a maximum distance of 2 millimetres from the host root of any *Striga* seed counted.

The results obtained are given in the following table:—

	% germination
Cow-Pea—	
(New Era Hybrid)	46.1
(Turiani)	50.0
(G.4.—Agri. Exp. Sta. selection)	43.0
(Dr. Saunders' Upright)	48.9
Dhal (*Cajanus cajan* (L.), Millsp.)	45.7
Velvet Bean 74 (Agr. Exp. Sta. selection) (*Mucuna deeringiana* (Bort.), Holland)	50.7
Velvet Bean 52 (Agr. Exp. Sta. selection)	40.3
Dolichos lablab, L. Less than	1.0
Wedge Pea (*Lathyrus sativus*, L.) Less than	1.0
Ground Nut (*Arachis hypogaea*, L.)	0.0

There is little to choose between the four cow-pea varieties, or between them and the Velvet Beans and Dhal. The germination induced by Wedge Pea and Dolichos lablab is negligible, and none whatever was observed for the ground nuts.

Conclusions. The fact that the Cow-Pea, Dhal and Velvet Bean are capable of stimulating the germination of tobacco witchweed seed, on a reasonable scale under laboratory conditions, suggests that they would also do so under field conditions. None of them have been seen to be parasitised by adult tobacco witchweed so far, but from the point of view of trap-cropping it is not necessary that they should. Germinated seed which fails to produce a mature plant will either die very quickly or produce an immature plant which never sets seed. In either case, the concentration of witchweed seed in the soil will be reduced. In this connection, the work of Andrews (1947) on the parasitism of *Striga hermonthica* Benth., is of interest. This plant is a parasite of *Sorghum* species in the Sudan, but Andrews has shown that it can also grow on the roots of groundnuts, cow-pea, dolichos bean, and soya beans, although only ill-nourished plants, which did not grow more than one centimetre above the ground, appeared. These plants did not come to maturity and he concludes by saying that in consequence these legumes could be used for trap-cropping.

Sunn hemp is the plant most frequently grown as a green manure crop in rotation with tobacco in Rhodesia. This has been shown to be incapable of inducing the germination of tobacco witchweed seed, and this is not surprising as witchweed infestations have still continued to build up rapidly in the Featherstone district in spite of the use of sunn hemp as a rotation with tobacco. It is therefore recommended that in areas badly affected by tobacco witchweed the sunn hemp rotation be abandoned and cow-peas, dhal, or velvet beans substituted instead. At least two crops could be grown of one or other of these if they were ploughed in while still young, i.e., from 6-8 weeks old. They would then serve as a useful green manure crop and at the same time help in the reduction of witchweed density. It will be some years before the relative efficiency of these crops as trap-crops under field conditions can be demonstrated, since it will be necessary to wait and see how clean succeeding tobacco crops become on badly infected soils, but it is hoped that some success will be achieved in reducing the constant wastage of virgin land on the affected farms.

One danger exists in the use of two of these suggested crops. The cow-pea and dhal are both, unlike sunn hemp, susceptible to eelworm which is equally dangerous to the tobacco farmer. Fortunately the velvet bean is relatively resistant to eelworm, so this should be chosen in preference to the other two if lands are also badly infected with eelworm.

Finally, it must be emphasised that it is most important for tobacco farmers to look out for the first appearance of this parasite on their tobacco. If the first few plants are removed before seeding, complete control can probably be achieved with very little trouble. It is well to remember that the parasite exists as an indigenous plant in all parts of Rhodesia.

SUMMARY.

1. The history of the occurrence of *Striga gesnerioides* (Willd.) Vatke as a parasite on tobacco in Southern Rhodesia is given.

2. The parasite and its mode of life are described.

3. Its known indigenous hosts are given.

4. Field trials showed that the tomato is also capable of being attacked.

5. The cow-pea, dhal, and velvet bean can induce the germination of the parasite, and these three crops are consequently recommended as possible trap-crops

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Care and Management of a Dairy Herd

By I. M. KRIGE, B.Sc. (Agric.), Animal Husbandry Officer, with notes on The Making of Compost, by S. D. TIMSON, M.C., Agriculturist.

There is considerable scope for dairy farming in Southern Rhodesia. The demand for dairy products far exceeds the supply, and large quantities of butter and cheese have to be imported annually to meet the consumption on a rationed basis. It is estimated that production will have to be more than doubled during the next five years to meet local requirements.

Over large areas of the Colony, climatic and soil conditions are very suitable for dairying, which also fits in very well with certain farming systems, to which it gives stability and permanence. It combines particularly well with maize and tobacco production, as ample supplies of feed can be grown. In the high rainfall Eastern Districts, where improved pastures can readily be developed, it should be encouraged in conjunction with soft wood afforestation. On the sandveld areas where the rainfall is over 30 inches and fairly extensive autumn and spring vlei grazing is available, dairying should be the main line of production. This should also be the case where irrigation facilities are available, such as below the Umshandige Dam. In the drier parts of the Colony, on the better soils, and in the more favourably situated parts, where the grazing is good and ample roughage crops can be grown, dairy farming on a small scale forms a very suitable and useful side line to beef production.

It is as well to point out and emphasise that without livestock the maintenance, let alone improvement, of soil fertility is impossible. For this purpose dairy farming is of particular value, as it enables large quantities of manure or compost to be made.

Choice of Breed and Type. Having decided to go in for dairying, it is of importance to choose a breed which will give the best returns. For this reason it is advisable to confine the choice to the recognised dairy breeds. The Friesland has proved itself to be among the best for dairying under local conditions, both for the production of milk and butter-fat. The Jersey is becoming very popular among cream producers, and should have a good future in the Colony. The Guernsey is also doing well and making

progress. Ayrshires have done best in the mountainous and misty areas of the Eastern Border and in the other cooler parts of the Colony. In the warmer parts they have not done well. In most parts and particularly in certain systems of farming, the dual purpose breeds are popular, particularly for the production of butter-fat. The Red Poll, Dairy Shorthorn and South Devon have all given good results under these conditions. The South Devon has done best in the higher and cooler parts, such as the water-shed country from Shangani to Inyazura and the Eastern Districts.

New producers would do well to visit successful dairy farmers in the area they intend farming, and see which breeds do best. Deciding on a breed which does well, and of which large numbers are available in the area concerned, makes it very much easier to obtain suitable and acclimatised breeding stock. It also often enables producers to exchange bulls.

Selection of Dairy Stock. Dairy heifers should be selected on general appearance, constitution, type and, if possible, records. Remember that with dairy cattle **"production is paramount, type is essential."** Bearing this in mind, try to get foundation heifers from herds in which good bulls have been used, selection has been practised, and milk records kept. This will enable the buyer to see what breeding and production they have behind them, and what type they are bred from.

The type to look for, if obtainable, should be deep and roomy, showing capacity for production. At the same time, it is important to pay particular attention to **constitution.** This is more so under our conditions than elsewhere. Look for animals showing good girth, strong frame and good strong legs and feet. If cows are selected, attention should be paid to healthy and roomy udders. Animals purchased should be brought on to the farm at a time when sufficient feed is available to provide them with all their requirements and particularly with a balanced ration when they come into milk.

STABLING OF DAIRY COWS

Cowsheds. When dairying is practised, it is important, for the production of clean milk, to milk in a roomy, well ventilated, hard-floored shed, with stanchions for each cow, and suitable mangers for feeding of concentrates. Roughage is best fed after milking or, during winter, in outside pens which are well bedded, shady and comfortable.

The shed should be cleaned out after each milking, and washed at least once daily to ensure that the milk is being produced under clean conditions. Plans of easily constructed, practical cowsheds can be obtained from the Chief Dairy Officer, Box 387, Salisbury.

Grazing Management. An intensive system of paddocking is essential for good dairy farming and maximum production. The

ideal to aim at is a large number of small paddocks with a convenient lay-out and in close proximity to the cow-byres so as to reduce to a minimum the distance which the milking cows have to walk for their grazing.

Vlei-land and dry-land pastures should be in separate paddocks so that they can be used to best advantage. Vlei grazing will be found most useful during the autumn, winter and spring months, while the dry-land grazing can be used to its fullest extent during the summer-growing period.

On dairy farms in those parts of the Colony where climatic conditions are sufficiently favourable, the establishment of improved pastures by planting suitable grasses offers great scope. Grass leys—useful for the summer feeding of dairy cattle or the making of high quality hay—fit in well with both tobacco and food production rotations on sandy soils and on the heavy maize soils. Providing the lands are fenced and a system of rotational grazing is practised and the pasturage grazed off rapidly and evenly, they can provide the cheapest source of protein and energy on a level much above that of the natural veld.

It is, of course, important to establish only species well suited to the particular soil and climatic conditions. It is also important that established pastures should be regarded as a crop and treated as such. On poor soils the use of compost and fertiliser are essential in building up fertility and may be most economically applied in the preceding cropping programme. At the Marandellas Research Station good dry-land established pastures of Star Grasses have been found to supply the maintenance needs of a dairy cow as well as the nutritional requirements for 1½ to 2 gallons of milk for a period of 5 to 6 months of the year. Production above this level requires supplementary feeding of concentrates.

Vleis can be improved by ploughing, phosphatic fertilising and liming, and planting or sowing with improved grasses such as *Paspalum dilatatum* and *P. urvillei* (upright paspalum), swamp couch and Nile grass. Vleis improved along these lines and well managed give good grazing during the dry period and are admirably suited to the grazing of young stock and dry cows. They also provide cheap roughage of good nutritive value for cows in milk where no feeding in pens is practiced during the winter.

Consult the Pasture Research Branch, Box 387, Salisbury, for any information you require on pasture development.

Pen Feeding in Winter. It is a well known fact that the value of the grazing over the greater part of the Colony deteriorates very considerably during the autumn and winter months. Very often it loses so much of its value that it does not even provide sufficient for maintenance. Under such conditions high quality

dairy cows lose more by walking long distances while grazing than they actually get from the poor quality grass they consume. The effects of this seasonal deterioration in grazing on production are well shown by the figures given below:—

Monthly Production of Creamery Butter in the Colony during 1946.

Month.	Total Butter Produced (lbs.)
January	177,109
February	159,418
March	146,539
April	119,397
May	89,396
June	62,461
July	50,744
August	38,580
September	30,940
October	35,984
November	44,867
December	95,500

During the dry season it has been found best to "pen feed" dairy cows. Under this system the cows are penned day and night in pens, allowing from 20 to 30 square yards per cow. (See Figs. 1 and 2, drawn up in consultation with the Dairy Branch.) In these they have access to all the good quality roughage they require, such as veld hay, legume hay, maize stover, etc. Silage is also fed in mangers twice daily. Every morning and afternoon the cows are taken to the stables for milking and the feeding of concentrates according to production. The pens should always be well bedded, which will keep the cows clean and make the production of large quantities of compost possible.

It has been found that production can be maintained at a high level during the months of May, June, July, August, September and October, and even November should it be a late season, if a system of proper penning and feeding of cows in milk is followed. This eliminates unnecessary walking and ensures the consumption of ample good quality roughage. The costs of this system are amply rewarded by the increased production obtained, as well as the increase in the price of butter-fat during these months. It should be emphasised that an essential part of the system recommended is the supply of good quality roughage in sufficient quantities.

It is as well to plan at the beginning of each cropping season for the production of the necessary feeds. **Approximately one ton of veld hay, one ton of legume hay and three tons of silage should be provided per cow. Remember that roughage feeds need never be wasted. Well made hay and silage can be kept for many years.**

Provision should be made for ample shade in the pens, and also water if possible. Dairy cows should be watered not less than three times daily.

To summarise, the advantages of pen-feeding dairy cows in winter are:—

1. Increased yield when prices are high.
2. Conservation of energy and condition in the cows.
3. The making of many tons of compost.
4. Better supervision.
5. Increased profits.

BUILDING UP AND MANAGEMENT OF DAIRY HERD.

Milk Recording. It is important that every farmer should know the production of each of his cows, so that the weaker producers and "boarders" can be culled and replaced by better ones. For this purpose the records of milk and butter-fat production of every cow should be kept. If weighing each day takes too much time, it can be done on one day in each week This system gives a fairly good idea of the production of the cow during the previous week. A milk recording scheme is run by the Dairy Branch, and details are obtainable from the Chief Dairy Officer, Box 387, Salisbury.

Milk recording makes it possible to feed each cow *according to her production.* This is essential, otherwise wastage occurs, which is decidedly not conducive to economical production. Full details of the feeding of dairy cows are given in Bulletin 1351, copies of which can be obtained from the Department of Agriculture.

High Producers much more Profitable than Low Producers. The importance of retaining high producing cows only is emphasised by hundreds of experiments carried out in every dairying country. In American herds it was found that on an average, the *highest producing cow in each herd returned more nett profit than the seven lowest producers.* The higher the standard of production, therefore, the greater the profits and the greater the possibility of producing at an economic level.

Regular Selection and Culling Essential. Old cows should be culled after the sixth lactation. After this, production ceases with each lactation. Cows at this age when sold in good condition and on the point of calving usually fetch good prices. All low producers, poor doers, shy breeders and poor type animals should be got rid of regularly, otherwise an unprofitable herd will soon result.

Regularity. To ensure that each cow will produce at her maximum capacity, it is desirable to have regularity in the routine followed. A cow is a highly temperamental animal and of nervous disposition—this is especially the case with high producers—so anything which is likely to upset her must be avoided.

One of the main ways of ensuring that the cow is kept happy and contented is to be strictly regular with her routine. Do not allow different labourers to milk her from day to day. Rather let one boy always milk the same cows. The cow must also be provided with one particular stanchion in the cow byre to which she must always be brought. Within a very short time she will take her particular place in the byre of her own accord.

Milk and feed at the same times on each day. The best course, as previously stated, is to feed concentrates before or during milking, and roughage afterwards. Stick to this order of feeding, and when any changes in the ration are brought about, effect them gradually.

Milking. The method of milking is a very important factor in the production of a cow. Many poor lactations are not due to lack of feed or other mismanagement, but simply to poor methods of milking.

The principles underlying the correct milking procedure are easily understandable, being based on the physiology of milk secretion. The important points to remember are: (1) That all the milk is present in the udder when milking begins. (2) The secretion of milk in the udder stops when sufficient back pressure has been built up by the accumulated milk in the udder alveoli (milk secreting recesses). (3) The milk will only be released as a result of the letting-down stimulus (4) The milk is let down about 30 to 50 seconds after the stimulus is given, and the action of the stimulus is felt only a short while. (5) The action of the stimulus can be destroyed or counteracted by exciting the cow.

Bearing the above points in mind, it will be realised that really high-producing cows should be milked more often than twice daily if their maximum production is to be obtained. Increases of 20 to 30 per cent. in daily yield have been obtained by milking three times per 24 hours. This practice is not worth while with up to three- to four-gallon cows, but pays in the case of higher production. It is important to have more or less equal intervals between milkings.

During milking it pays to handle cows gently and quietly, and more especially if the cow is an excitable one. To provide the stimulus for letting down milk, the udder must be washed down with warm water just prior to the milking operation. The hand-milker or machine must commence milking about half a minute later.

The milking must be carried out swiftly for best results, otherwise the operation will not be completed by the time the stimulus has ceased its action, and incomplete milking will result. Cease milking, whether by machine or hand, when the letting-down process has stopped, otherwise the cow becomes used to a longer milking period, lets down her milk more slowly, and incomplete milking results. When machine milking, strip by machine as well, otherwise the cow, if used to hand stripping after machine milking, will not let her milk down completely with the machine, and the milking operation is unnecessarily prolonged.

Always treat the cow as an individual, being especially careful with the management of the excitable and temperamental animal. Use the same milker on the same cows at every milking, as his ways and odour become familiar to the cows and affect the letting down stimulus with each. No unnecessary shouting, noise and movement should be tolerated in the byre at milking time.

Milking Machines. Owing to the difficulty in obtaining good native milkers in the territory, dairymen are turning their attention to the possibilities of machine milking, and there is little doubt that in spite of the fact that they are somewhat costly to instal, milking machines will ultimately become an important factor in advancing the dairying industry in the Colony—in fact, as the dairy herds improve, they may become a necessity. Experiments have shown that they are economical to operate, have no appreciable effect on the yield or composition of the milk, and are unquestionably preferable to the average type of African hand milking.

The following useful instructions by Professor Petersen, of Minnesota, on the application of the technique to the routine of milking with machines will be found useful:—

1. Wash and stimulate cow No. 1.
2. Wash and stimulate cow No. 2.
3. Attach machine to cow No. 1.
4. Attach machine to cow No. 2.
5. Wash and stimulate cow No. 3.
6. Machine strip cow No. 1.
7. Attach machine to cow No. 3.
8. Wash and stimulate cow No. 4.
9. Machine strip cow No. 2.
10. Attach machine to cow No. 4, etc.

Where machine milking is practiced, it is very important that the instructions of the manufacturers should be carefully followed. Poor results are often obtained where this rule is not adhered to. Although machines are labour- and time-savers, they can be a source of trouble if teat cups are not carefully disinfected between the milking of each cow. Chloride of lime solution is useful for this purpose.

In conjunction with machine milking, the use of strip cups to detect clots in the milk—an indication of mastitis—is strongly recommended. Every cow should be tested by this method before putting on the machine, and if there is the slightest sign of mastitis developing, milk by hand.

After milking is finished, it is a good practice to tail-dress and groom down each cow quickly with a brush. This removes dust from the cow and makes her feel in better trim, while her

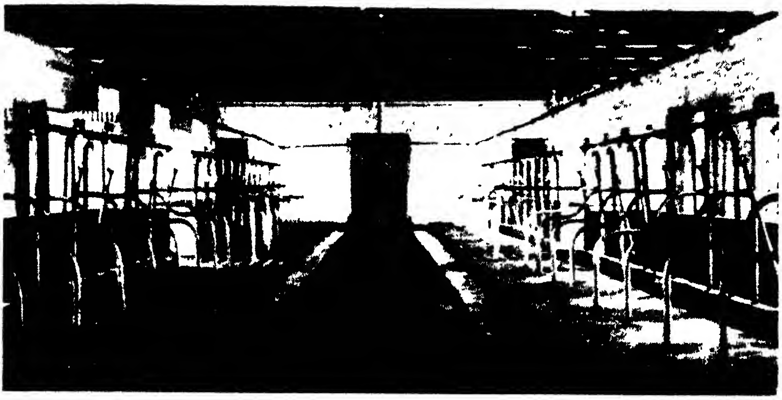
A fine example of the Jersey breed. Fairseat Zenith produced 10,442 lbs milk and 504 7 lbs. butterfat in 300 days as a 3-year-old.

A family of strongly constituted, capacious and high yielding Friesland cows.

Surge milking machines in operation at Grasslands Experimental Station.

Deep bodied high producing dairy cows grazing on ley pasture grasslands, Marandellas.

The most valuable by-product from dairying or steer fattening.



A well constructed cowshed with modern fittings.

A simple open type byre as found on most Rhodesian dairy farms.

Portion of the dairy herd at Grasslands Experiment Station, Marandellas

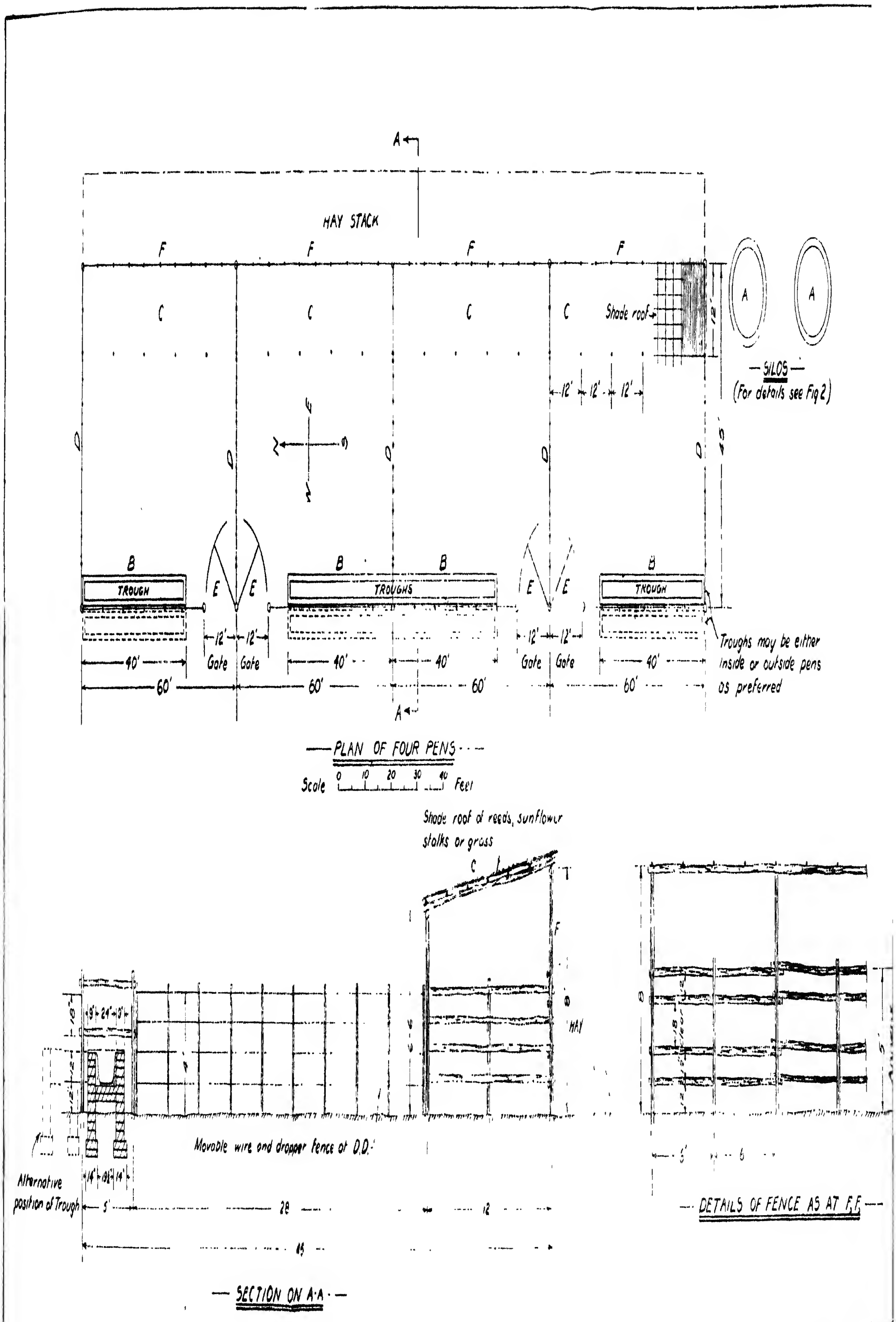
Herd Average 1946-47

Breed.	Milk lbs.	Butterfat lbs.	% Butterfat	Days.
Grade Friesland	9,935.5	357.5	3.60	294

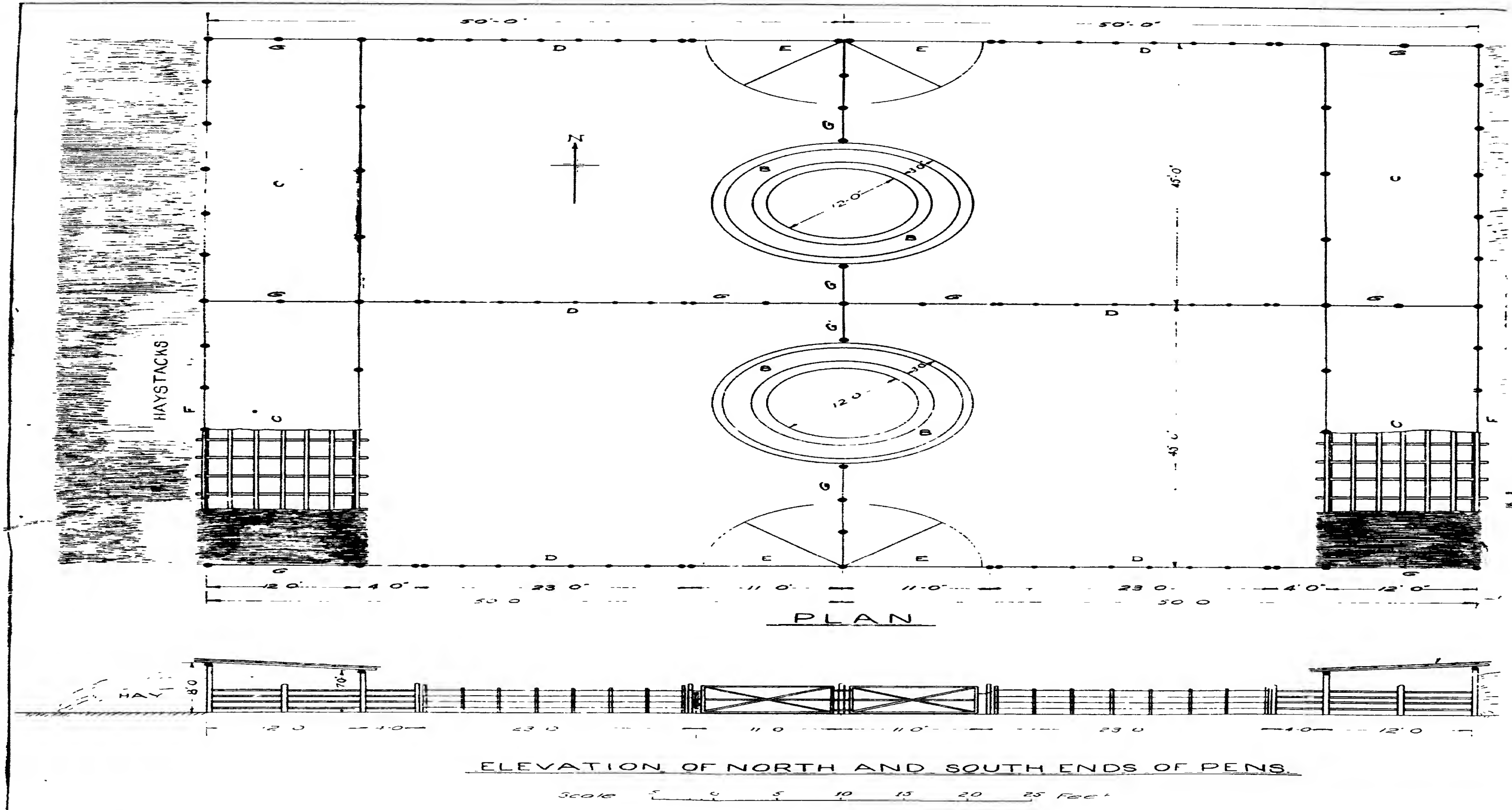
A useful lean to milking place

An excellent Friesland cow on very good pasture.

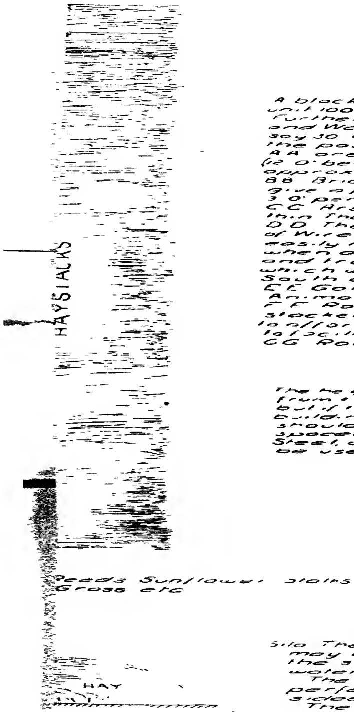
In-milk Frieslands on improved vlei pasture at Grasslands Experiment Station, Marandellas.



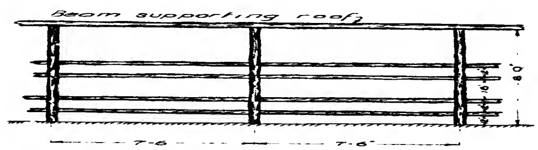
WINTER FEEDING PENS FOR DAIRY ST



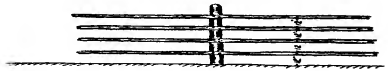
WINTER FEEDING PENS FOR



A block of 4 Pens each 30 0" x 45 0 form a unit 100 0" x 90 0" to accommodate 40 Cows Further units may be erected on the East and West sides but a sufficient space of say 30 0 must be left for Haystacks and the passage of Wagons
AA are Pit Silos 12 0 Diameter x 16 0 Deep (12 0" below ground and 4 0 above) to hold approximately 33 tons of ensilage
BB Brick feed Troughs round Silos which give a feeding space of approximately 3 0" per head
CC Are light shade roofs covered with thin Thatch, Sunflower Stalks, or Reeds
DD These are Concertina type fences of Wire and Droppers which can be easily removed for the passage of wagons when delivering ensilage or collecting and transporting Muck to Compost heaps which would be on the North and/or South of Pens
EE Gates to each pen for daily use of Animals
FF Rail fence against which Hay is stacked on East and West sides of pens to afford protection from weather and to facilitate feeding
GG Rail fences dividing pens

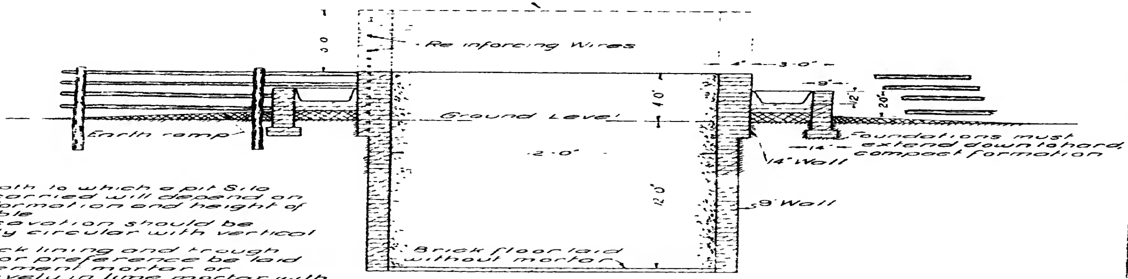


RAIL FENCE AS AT F.F.



RAIL FENCE DIVIDING PENS AS AT G.G.

The height of the Silo wall may be increased from 4 0 to 9 0 above Ground Level as indicated, but if this is to be done, either at the time of building or subsequently the 14" brickwork should be reinforced with 12 rings of wire spaced as shown 10 or 12 Gauge High Strain Steel, or 8 Gauge Galvd. wire should be used



Silo The depth to which a pit Silo may be carried will depend on the soil formation and height of water table
The excavation should be perfectly circular with vertical sides
The brick lining and trough should for preference be laid in 1 to 5 cement mortar or alternatively in lime mortar with an admixture of 10% cement In either case the surface should be plastered with 1-3 cement plaster not less than ½" thick

SECTION THRO' PIT SILO & TROUGH.

Scale 1 0 1 2 3 4 5 6 7 8 9 10 Feet

DAIRY STOCK. FIG. 2

Irrigation Department
Salisbury 14.5.48

appearance is improved as well. It should be done after the milking of all the cows has been completed.

Drying off the Cow. It is never advisable to continue milking through from one lactation to another. In the first place, it often leads to a loss of colostrum, so essential for the calf after birth, while in the second place, the milk produced by a cow heavy in calf is inclined to thicken with heating, and turns quickly. She needs a rest of six to eight weeks to build up her reserves before the next lactation commences.

The best method is to reduce the feed and not to milk regularly, leaving a little milk in the udder each time.

When feed is reduced, roughage only and no succulent feed or grain should be fed With the above method, the cow should dry off in a few days. With cows producing a gallon of milk or less daily at the time of drying off, reduce feed and cease milking completely. Back pressure in the udder will stop milk secretion.

Feeding During Dry Period. Once dry, the cow should be brought on to a light grain ration. The ration should be flesh-forming, so that she may be brought into good shape for calving. In medium condition, 4-6 lbs. of concentrates, with good roughage, should suffice; if lower in condition, 8-10 lbs. of concentrates should be fed

During the summer, dry cows should do well on good grazing only. It must constantly be borne in mind that good condition is to be aimed at before the cow calves down. This leads to better production during the lactation.

About two weeks before the cow is due to calve down, the grain ration should be considerably reduced and a laxative ration should be fed, in which most of the maize has been replaced by wheat bran or some other laxative feed.

Periods Between Calvings. The average gestation period for cows is from 278 to 282 days. Bearing this in mind, the farmer can regulate his cows to calve every 12 months. This has been found most suitable from a production point of view. In other words, try to get the cow in calf 2-3 months after calving. This would allow her a 10-month lactation and two months' rest before calving again.

Calving Time. At this stage laxative feeds, such as wheat bran, ground nuts, linseed meal, sunflower head and seed meal and succulents, must be fed, otherwise calving or after-birth trouble might result.

If the after-birth has not come away within 12 hours after calving, remove it carefully by hand. See that the nails are clipped short and the hands are clean. Wash the cow down with slightly warm disinfected water (Dettol) under the tail. Oil the arm and hand to be inserted with a mixture of 1 part healing oil to 4 parts sweet oil as often as necessary to ensure lubrication. With the one hand twist the protruding portion of the after-birth, on which tension must be exerted throughout the operation. Insert

the other carefully into the uterus and start unbuttoning the cotyledons adhering to the womb, starting from the front and working forward and downward until the after-birth is unbuttoned and comes away. Scoop out any blood and other loose matter within the uterus. If there is much bleeding, wash out the womb with a 1 in 4,000 neutral acriflavine solution, or a permanganate solution. Scoop this out after the douche and then insert an intrauterine pessary. Repeat the insertion of the pessary daily for two days.

Calving time is a most important period in the stockman's routine. At all times cows need constant attention, but this is particularly so when they are due to calve. The farmer should know the approximate time of calving from his breeding record, and be able to judge by the swelling of the udder, the relaxation of the muscles next to the tailhead, and the behaviour of the cow when calving is due to commence. Just before calving, cows should be placed in a loose-box, about 14 ft. by 14 ft., which is well bedded, or in a small, clean, protected calving paddock.

Do not remove milk from the udder before calving, unless absolutely essential. If it becomes greatly congested, rub forward with a mixture of codliver oil and ethyl alcohol in equal parts, or with coconut oil.

If a laxative ration is fed before calving, the cow will not show signs of constipation. If, however, she becomes constipated, dose her with 1-1½ pints of raw linseed oil.

A good stockman will always pay extra attention to cows due to calve. In this way he is in a position to save both mother and calf when difficulty is experienced. Many valuable cows have been saved by assistance at this time.

If the calf is weak after calving and cannot help itself to the first meal, it must be assisted to suckle. It is most important to let the calf have the colostrum or first milk from its dam. After 12-24 hours the calf is separated from the dam and raised on its own and fed its dam's milk for the next 4 days. The milk is usually fit for human use after about the 5th day.

Care After Calving. After calving, it is usual to increase the concentrates gradually, otherwise udder and digestive disturbances may result. Feed none the first day, but give plenty of water, roughage and silage. Hereafter increase the ration slowly until the cow is on full feed in 2-3 weeks' time. Should the udder become swollen and congested, reduce the amounts of concentrates and milk out 5-6 times daily.

Age at First Calving. This depends entirely on the growth of the heifer. Under our conditions, if well grown at 18-24 months, they may be bred. If not too well grown, breed a little later. If necessary, feed liberally after service until calving, so that the heifer makes all the growth necessary . Lighter breeds, such as the Guernsey and Jersey, can be bred somewhat earlier than the Friesland. Care should be taken not to delay breeding too late, as this often leads to sterile heifers or queans.

The Making of Compost

By S. D. TIMSON, M.C., Agriculturist.

Every dairy farmer and every farmer fattening cattle is advised to so organise his operations as to produce the greatest output of compost per beast that is possible, because therein lies much of the profit from his cattle, albeit it is an indirect profit. The fattening and winter pens should be looked on as a compost factory.

Value of Compost. As a rough generalisation, it can be said that one ton of compost can be expected to give an increase in the yield of maize of one bag per acre on maize soils that are deficient in humus, and appreciably more on sandy soils. When applied to crops such as potatoes, onions, tobacco and vegetables, which give a higher cash return per acre than maize, the profit from the use of compost will naturally be appreciably higher.*

Another most important point of view regarding the use and value of compost is that every 8 tons (16 cubic yards) of compost produced can release one acre of land from idleness under green manure and so keep it in production. And such increased produce (less the cost of production, from which must be deducted the cost of growing a green manure crop) represents clear profit to the farmer.

Output per Beast. When the raw materials are in ample supply, that is, the bedding for the fattening cattle or cows, such as veld grass, crop wastes, leaves of trees, etc., then an output of 5 tons (10 cubic yards) of moist, ripe compost per beast per month *can* be reached. Two farmers are known to have attained an output of just 4 tons of compost per beast per month. In one case the oxen used were a small native type, and were fed a maintenance ration only.

Raw Materials Required. Where fattening cattle are given only sufficient bedding to keep them clean, as is the normal practice, an output of no more than about half a ton to one ton per beast will be obtained. It is clear, therefore, that much larger quantities of bedding will be required to reach the highest possible output of compost from the fattening pens.

In addition to the usual bedding of grass, all crop wastes, such as maize husks, cores and stalks, wheat straw, sunflower stalks, tobacco and cotton stalks, spoiled hay and silage, sunn

*** In experiments at the Trelawney Research Station in 1946-47 one ton of compost (20 per cent. moisture) gave an increased yield of tobacco worth at current prices (39.00d. per lb.) £10 16s. These results were obtained on land that had grown two crops of tobacco and had then lain under natural grass fallow for 4 years.**

hemp stalks, etc., should be placed in the pens. Leaves of trees and moderate quantities of sawdust can also be used—in fact, any matter of vegetable origin that is not too woody.

Where the quantity of wastes is not sufficient, consideration should be given to the growing of permanent bulky crops, such as Napier fodder, Rhodesian Sudan grass, and the tall thatching grasses for the purpose. Napier fodder grown on the contour ridges (where witchweed is not troublesome) can supply very valuable early grazing before the rains, and then be allowed to mature and cut for compost. The reclamation of the crumb-structure of arable soils by the above grasses can go hand in hand with the production of compost raw materials, and the provision of early spring grazing (in the case of Napier fodder and Rhodesian Sudan).

Filling the Pens and Frequency of Emptying Them. Before the cattle are put into the pens, bedding to a depth of at least a foot, and preferably 18 inches, should be spread over the floor in order to absorb the most valuable liquid manure. Sawdust is particularly useful for this, and then maize husks and veld grass.

Every few days, as the cattle tramp down and soil the bedding, more wastes are spread in the pens until a depth of 1½ to 2 feet of well trampled wastes is reached, when the pens may be cleaned out and refilled as before.

One native can clean out an area of 60 square yards of the pens in one day, by throwing the bedding out over the side of the pens with forks, where a depth of bedding is 1½ to 2 feet.

If a greater depth than 2 feet of trampled wastes is allowed to accumulate, the labour of cleaning out the pens is much increased, since picks and mattocks may be required instead of the much easier work of forking.

When a farmer has ample supplies of bedding wastes, and he wants to make the maximum quantity of compost, the pens can be cleaned at intervals of as many days as there are square yards of pen space per beast. For example, if the area of the pens allows 15 square yards per beast, then the pens can be cleaned out every 15 days. This will ensure that ample nitrogen is supplied in the dung and urine to ensure the proper rotting of the wastes. **This figure is based on a depth of 1¼ feet of trampled wastes in the pen.** If a greater depth of wastes is allowed to accumulate, then the number of days allowed before cleaning the pen must be increased in proportion.

Where bedding is limited, the frequency of cleaning out the pens will be regulated, of course, according to the supply of bedding.

Other Materials Required. In the making of compost some soil and a little wood ash or agricultural lime requires to be mixed with the wastes to assist the fungi and bacteria that bring

about the break-down of the latter. These are best added in the pens from time to time, since this ensures their being well mixed with the bedding.

The table below shows the quantities required for every 100 square yards of floor space in the pens:—

Materials.	*Total Quantities per 100 Square Yards.*
Soil	2 to 4 Scotch cart loads or 12 to 24 bagsful.
Wood Ashes	2 to 4 bags.
or	
Agricultural Lime	2/3rds to 1⅓ bags.

In order to ensure even mixing, spread the above materials over the bedding in the pens (just before putting down fresh bedding) in 2 or 3 portions of the above total quantities.

If the waste materials are chiefly soft, such as grass and wheat straw, the half rate of soil only is needed. If they are hard and woody, such as whole maize stalks, mature sunn hemp and cotton stalks, use the full quantity of soil. If the soil is sandy, use the half rate of soil and increase the quantity of lime or wood ash.

Compost can be made without the use of either soil, wood ash or lime, but the decay of the wastes will be slower and less perfect without them, and the finished compost of poorer quality. In the drier areas of the Colony the use of soil is particularly advisable, since it helps to economise water.

Making the Heaps and Turning Them. After being removed from the pens, the soiled bedding is made into heaps 3 yards wide by 4 feet high, and of any convenient length. Make the heaps in pairs with only a foot or two of space between them, so that when they have sunk, after decay is well advanced, the two heaps can be thrown into one and thus be less liable to drying out.

After 5 or 6 inches of rain have fallen and penetrated about 6 inches into the heap, it is turned with forks, working from one end or one side, and built up into new heaps. The wet wastes should be well mixed with the dry portion, any matted lumps well shaken out, and the whole heap left loose and well aerated.

Keep iron rods or hard sticks thrust into the heaps to act as rough thermometers. After the first turn, these should become so hot within a day or two that they cannot be tightly grasped in the hand.

The temperature will then tend to fall gradually, and **the next turn should be given while the heap is still quite warm.** Usually the second turn should be made in 2 or at most 3 weeks,

but watch the temperature, and if the heap is cooling unduly, turn it at once. It is difficult to re-start the heating of a heap that has been allowed to cool too much.

The third turn may be given in about 3 or 4 weeks. Normally the compost is ripe in 3 months following the first turn, when it looks and smells like well-rotted leaf mould.

At the time of the second turn, the materials should be covered with the greyish-white mycelium of the fungi that are breaking them down.

Keep the tops of the heaps level and the sides tidy, since this assists the retention of moisture.

Labour Required for Turning the Heaps. On the average, over all the turns one native can turn with the fork about 20 cubic yards per day. He will turn less than this at the first turn, but at subsequent turns he can turn much more, since the materials are then partially broken down and easy to handle.

The turning of the heaps is the ideal job for wet mornings during the rains, when oftentimes no other work is possible.

Design of Pens. In designing the fattening pens, bear in mind the need to get the bedding into the pens and the soiled wastes out of them easily, and, if possible, by mechanical means.

The ideal design will allow wagons to be driven right through the pens, or allow hay-sweeps to be driven into them when filling them with wastes, and tined dam scoops to be used for emptying them.

With the shortage of labour, compost making must be mechanised as far as possible, and a plan for a set of feeding pens designed to facilitate this and permit the maximum output of compost is appended.

Space for the Compost Floor. Another matter to be borne in mind is the need of sufficient open space next to the pens on which the compost heaps can be made.

Where the monthly production per beast is 4 tons, an area of about a quarter of an acre (1,200 square yards) will suffice for the compost produced by 20 head in 3 months' feeding. This allows for 4 heaps each 40 yards long by 3 yards wide, with a space between each pair of 1 yard, and 10 feet between the 2 pairs to allow the passage of a wagon. A space of 12 feet at both ends and both sides is allowed for wagon and other traffic.

In the drier parts of the Colony in particular, it is advisable to site the heaps so that their long axes lie across the direction of the prevailiing winds, so that they protect each other from undue drying out by the wind.

Where tined dam scoops or other mechanical aids are to be used to clean out the soiled bedding from the pens, the compost floor should be opposite the exit from the pens so that the dam scoops can be driven straight ahead to dump their loads at the compost heaps, thus economising labour.

SUMMARY.

1. Breed and select for a deep, broad, roomy type with well developed udders.
2. Cull regularly on production and retain heifer calves from high producers only.
3. Only under sound methods of feeding and management will dairy stock develop as they should.
4. Record all cows.
5. Feed individually according to production.
6. Pen-feed cows in winter.
7. Well-managed pasture is the cheapest feed.
8. Milk cleanly, rapidly and efficiently for maximum production.
9. All good cows need a two to three months' rest before calving. Dry-off in time and feed well during dry period.
10. Attention is essential at calving time.
11. Only breed sufficiently well-grown heifers.
12. Make every possible ton of compost to feed the soil, so that it can feed more cows and feed them better.

IF IN DOUBT, DO NOT HESITATE TO WRITE FOR INFORMATION.

Report of the Division of Entomology for the year ending 31st December, 1947

By M. C. MOSSOP, M.Sc., Acting Chief Entomologist.

AGRICULTURE.

Red Locust (Nomadacris septemfasciata, Serv.). There have been no reports of the presence of the Red Locust in the gregarious phase, and the Colony appears to have been quite free of this plague for over three years. It is possible that the species persists in the solitary phase, but the professional staff kept on the alert for it and has not been able to obtain any specimens or suggestions of their presence.

Intensified action against locusts in the outbreak area in the south-western portion of Tanganyika, for which the International Red Locust Control Service is responsible, and against swarms which had escaped from the area, became necessary, and Southern Rhodesia's financial contribution towards this work was accordingly increased. At conferences attended by the Chief Entomologist in Lusaka and Abercorn in June, other funds were asked for in order to experiment in the control from the air of locust adults on the ground. The tests were carried out and met with gratifying technical success. It is expected that a report on this work will be published at an early date. At a conference held in Pretoria in December, attended by the writer, it was agreed that the next tests should include spraying from the air against locusts in flight, in order to provide a technique for dealing with migratory swarms. These tests will commence in April, 1948, if participating governments agree.

An International Convention to establish an organisation for at least ten years to deal with the Red Locust in the outbreak areas and possibly elsewhere was discussed at Lusaka and Pretoria, and included the Belgian Congo, the Union of South Africa, His Majesty's Colonies and High Commission Territories, and Southern Rhodesia. It is likely that the Convention will be signed by all parties early in 1948.

Regarding immediate local prospects, it does not appear that there will be a locust hopper outbreak in the Colony in 1948.

Army Worm (Laphygma exempta, Wlk.). The outstanding insect outbreak of the year was that of Army Worm. Early in January, 1947, reports of the destruction of maize crops on two farms at Hunter's Road were received. There were no further reports until the following season, when, on 23rd December, an outbreak in maize on two farms at Gatooma was reported. The number of known infested farms at Gatooma soon increased to a dozen or more, and by the end of the year reports had also been

received from the districts of Victoria, Salisbury and Nyamandhlovu, the outbreak at the last-named place being extensive.

It soon became obvious that practically all of the infestations in maize lands were not due to invasion from outside, but were due to eggs having been laid on the grass weeds in the lands. The weeds having been either consumed by the caterpillars or cultivated, the caterpillars turned their attention to the maize. Farmers were urged by radio broadcasts and the Press to watch for the outbreaks, and, on discovering them, to take immediate action in the form of utilising native labour to knock them from the plants (they fall very readily) and destroy them on the ground. To what extent this was done has not been reported, but it is believed that the method met with success where it was applied with confidence and vigour.

Chemical control appeared to be favoured, but the average farmer does not have a sufficient stock of knapsack sprayers or dusters with which to apply them, and most of the farmers affected appeared to have none. If the pest is discovered sufficiently early, one or two sprayers may be sufficient, but it is unfortunate that, despite warnings, few, if any, of the outbreaks were discovered before the larval cycle was about half completed. In any case, suitable available chemical sprays could not be advised, but after a few days' experimental work by the research staff of the Cotton Research and Industry Board, Gatooma, confirmed by Messrs. Pest Control, Ltd., and the professional staff of this Division in co-operation, a tentative recommendation of 0.5 per cent. technical D.D.T. and 0.25 per cent. gamma B.H.C. (benzene hexachloride) was made. The wettable powder form of the chemicals was used. Later, a straight 0.5 per cent. D.D.T. in emulsion form, formulated for plants, was also found to be effective, was considerably cheaper, and formed the basis of tentative recommendations for control in maize lands.

As far as possible, knapsack sprayers were issued on loan to farmers, and insecticides were made available for purchase by them. The meagre supply of sprayers, however, soon became exhausted. The use of stirrup pumps, as normally applied, is a pitiful waste of labour and materials, and very few were issued. Experience with army worms in maize lands suggests attack from the air as the answer in cases where precautionary measures have not been taken or have failed.

At the time of writing, the seriousness of the outbreak from a national aspect cannot be foreseen, but some individual farmers have suffered very heavy loss.

Other Pests of Cereals and Grasses. One of the maize snout beetles (*Tanymecus destructor*, Mshll.), which was found to be damaging young maize plants at the Agricultural Experiment Station in Salisbury during December, was later found to be controlled, apparently by the 2½ per cent. D.D.T. dust applied to the plants for the purpose of controlling the maize stalk borer (*Busseola fusca*, Hmp.), the dead snout beetles being found in surprising numbers on the ground.

An insect which has been regarded as a curiosity rather than a pest of graminaceous plants may have to be regarded as a pest under certain conditions. It is the subterranean scale insect (*Margarodes*, Sp.), which is closely associated with fine varieties of *Cynodon dactylon* grasses under bowling green conditions in which the grass is kept mown very short and the root system is automatically reduced in proportion. The insects discarded their cysts and became active in October.

Pests of Leguminous Crops. The late but sudden onset of the soaking rains, preceded by drought conditions, were responsible for the short period over which the emergence of the sunn hemp beetles, chiefly *Exora discoidalis*, Jac., and *E. apicipenne*, Jac., occurred on the Agric. Experiment Station, Sby. At first a light emergence was noted at the station on 29th November after soaking rains of 0.56 ins. on 27th and 0.61 ins. on the 28th. After a further 0.90 ins. on 29th to 2nd December, the emergence represented 89 per cent. of the total for the season under 20 ground cages each of one yard square. The population of beetles on this land was estimated at over three-quarters of a million per acre. A point of interest was that *E. apicipenne*, usually in smaller numbers than *E. discoidalis*, was far more numerous than the latter this season. The smallest damage is caused by the beetles when the crop is sown either late or at a considerable distance from the immediately preceding season's sunn hemp crop. No guide can yet be offered regarding the extent of this distance under different circumstances.

Species of blister beetles, known as "C.M.R." beetles (*Mylabris*, spp.), commonly attack many kinds of flowers, but can become a serious pest on peas and beans, especially when these are grown for their seeds. Reports of this type of damage came from Gwelo in December.

Adults of the sporadically appearing Bean Leaf Beetle (*Ootheca mutabilis*, Sahlb.), a Chrysomelid, heavily infested *Sesbania aegypti* in a Salisbury garden in January and damaged small plantings of peas and beans in December.

Pests of Solanaceous Crops. Of catholic tastes and normally a minor pest, the Prodenia Caterpillar (*Prodenia litura*, Boisd.), was reported from several widespread sources during February and March, and again, in the new season in December, doing severe damage to tobacco seed-beds and field tobacco. In the cases of field infestation investigated, the pest appears to have been carried from the seed-beds to the lands on the transplants. The insects were sufficiently numerous to be mistaken by farmers for army worm (*Laphygma exempta*, Wlk.).

Other insects occasionally reported as damaging tobacco are the small Curculionids (*Analeurops cuthbertsoni*, Mshll.), which severely damaged plants in the seed-beds in November, and what is believed to be a species of *Mimaulus*, which in vast numbers defoliated a considerable quantity of tobacco on one farm in Darwendale in December. Tobacco White-Fly (*Bemisia rhodesiaensis*, Corb.), was found in December infesting disregarded tobacco re-growth.

Of white grubs found in tobacco fields in the Lomagundi district and elsewhere, the following Rutelids and Melolonthids have been found to be destructive to the tobacco crop by damaging the roots:—*Anomala exitialis*, Per., *A. opacicollis*, Per., *A. pinguis*, Per., *A.* spp., *Schizonycha profuga*, Per., *S.* sp., and *Genyoschiza*, sp.

There were fewer reports than usual to this Division on pests attacking potatoes, except for eelworm or root knot gall-worm (*Heterodera marioni*, Goodey). The reason for the reduced reports of insect pests is that potato growers are limited in number and are mostly within easy reach of Salisbury, where a commercial pest control organisation is making headway and is gaining the confidence of the growers. In the past our advice was sought, and, if taken, possibly insufficiently well carried out. It is now being realised, however, that with a lucrative crop like potatoes it pays to incur some expense to treat the crop adequately against insect pests, and interested growers are now becoming anxious to avail themselves of the services offered by the firm.

Potatoes from two sources were found to be infested with nematode (*Pratylenchus pratensis*, de Man, Filipjev). This is a new record for Southern Rhodesia, and only the second for Southern Africa. Little is known of its habits or economic importance.

Pests of Crucifers. Bagrada Bug (*Bagrada hilaris*, Burm.) was active, as usual, through the dry season, but at Fort Victoria, where the 1946-47 rains were exceedingly late and meagre, the destructive activities of these insects continued until February.

The Carrot Aphid (*Anuraphis*, sp.) damaged carrot plants very severely, sometimes causing all of the foliage to wilt and die.

Pests of Cucurbits. Adults of the two Chrysomelid beetle species (*Hyperacantha fenestrata*, Chp., and *Asbecestra cyanipennis*, Jac.) are reported to have done severe damage to young pumpkin plants in January.

There were numerous attacks by Trypetids, including *Dacus*, spp., which are frequently a limiting factor in growing cucurbits such as cucumber, melons, etc.

Pests of Cotton. The following notes on cotton pests are condensed from a Progress Report written and kindly supplied by Mr. A. H. McKinstry, of the Cotton Research and Industry Board's Station at Gatooma, and refer to conditions on the Station.

Attack on cotton by the American Bollworm (*Heliothis armigera*, Hbn.) was unusually light. It is believed that the reason for this was the lengthening of the planting period and the consequently long period over which the tasselling stage of maize, attractive to the moths, extended. The unusual weather conditions which prevailed brought about these conditions. The main flight of maize-bred moths was too late, in relation to the flowering of cotton, to be serious.

The greatest loss to young squares, before and soon after flowering, was caused by the Sudan Bollworm (*Diparopsis castanea*, Hmp.), and the larvae of this species were more numerous than during the last few seasons. About ten per cent. of the loss of mature bolls included damage due to bollworm. As control measures to reduce Sudan Bollworm damage in the early crop are likely to result in an increase in the yield of seed cotton per acre, experiments aimed at control early in the season are being carried out.

Damage by Cotton Stainers (*Dysdercus*, spp.) was not heavy, about 90 per cent. of the weight of seed cotton being classified as unstained. Experiments with modern chlorinated insecticides against stainers show promise.

A Chrysomelid beetle identified as *Monolepta*, near *morio*, Jac., was responsible for severe foliage damage in a limited area, and must be watched as a potential pest. Control by benzene hexachloride dust was satisfactory. This beetle was also found feeding on leaves of *Lonchocarpus capassa*, soya bean, and a common weed (*Portulaca oleracea*, L.).

Pests of Fruit Trees. Experiments carried out at Umtali during July and August show that the Tingid Olive Bug (*Teleonemia australis*, Dist.) can be killed by applications of D.D.T. sprays and dusts, but the matter of formulations and concentrations needs study. The number of trees available for experiment is sufficient only for trials on a small scale.

Trypetid fruit flies, chiefly *Pterandrus rosa*, Karsch, and *Ceratitis capitata*, Wd., are serious pests of deciduous fruit, and complaints appear to be received mostly from peri-urban residents whose orchards are intended to be an auxiliary but lucrative source of income. Many of these orchards receive insufficient attention and are a danger to others. However, suitable control of fruit flies can be achieved by regular foliage applications of sweetened sodium fluosilicate bait.

The following information on citrus pests, based on conditions at the British South Africa Company's Citrus Estates, is compiled from information kindly supplied by Dr. A. A. Morris, Chemist and Chief Technical Officer at the Company's Mazoe Estate:—

Old trees appear to retain their comparative freedom from attack by Red Scale (*Aonidiella aurantii*, Mask.), the parasitic fungus (*Fusarium cocciphilum*), continuing to be in evidence. Infestation by Red Scale was moderately severe on young trees only. Citrus Thrips (*Scirtothrips aurantii*, Faure) was widespread but caused limited damage. Australian Bug (*Icerya purchasi*, Mask.) became fairly widespread following applications of D.D.T., but showed signs of abatement with the restoration of the Coccinellid predators (*Rodolia*, spp.). Other normal pests of citrus were relatively unimportant.

Pests of Forest and Shade Trees. Chrysomelid beetles of the genus *Calasposoma* were reported feeding on the leaves of young wattle trees at Melsetter, doing but slight damage. The roots of seedlings of *Eucalyptus*, sp., were found to be slightly infested by

root knot nematodes (Heterodera *marioni*, Goodey). In October, the Large Sand Cricket (*Brachytrypes membranaceus*, Drury) destroyed young thuya plants in Salisbury district and young cypress plants in Marandellas by biting through the stems.

Pests of Miscellaneous Crops and Garden Plants. As usual, damage was caused by root knot nematode in a wide range of plants. Unidentified white grubs did considerable damage to pasture land, mostly *Cynodon* grasses, at the Vumba, becoming most evident in July. From two sources in suburban Salisbury the grubs of an unidentified long-horned beetle, probably *Nitocris*, sp. (Cerambycidae), were reported to be boring in the stems of *Gardenia*. Holes to the exterior are made at somewhat regular intervals, presumably for the disposal of frass and for ventilation, including humidity control. In specimens kept in the insectory, no holes were made after the wood had dried out, though tunnelling continued. Apparently the same species was found in Umtali in August. Adults of the Cerambycid Olive Borer, or Sombre Twig Pruner (*Thereladodes kraussi*, White) were found in association with olive trees in Umtali in December.

Pests of Stored Products. The almost unprecedented drought experienced throughout the Colony limited the amount of grain and pulses produced and tended to reduce their moisture content to a level less favourable to insect attack than normal. Some imported maize was shown to be heavily infested with the Maize Weevil (*Calandra oryzae*, L.), but owing to the general shortage it is likely that a heavier infestation than normal was tolerated, and there were not as many complaints as might have been expected.

Adults of the Stored Tobacco Beetle (*Lasioderma serricorne*, F.) were collected weekly from store-room walls and surfaces of tobacco bales at different intervals after these surfaces had been sprayed with 10 per cent. D.D.T. wettable powder. Other specimens were collected weekly from unsprayed like surfaces from another building. In collections made up to six weeks after spraying, more than 90 per cent of beetles from sprayed surfaces were dead or moribund in two days, whilst an average of only 15 per cent. collected from unsprayed surfaces were in this condition after the same period. The death rate of beetles collected from the sprayed surfaces continued to be greatly in excess of that from unsprayed surfaces for three months, after which observations ceased.

Miscellaneous Insect Records. Circumstances coincident with the severe drought tend to confirm at least two working principles. One is that control measures against *Pheidole* and other small black or brown ants which carry away germinating seedlings from tobacco seed-beds are no longer necessary after the commencement of the planting rains, which normally occur in November or early December. On a farm near Salisbury the advent of these rains was delayed until after 23rd January, 1947, and the ants continued their raiding activities until that time. It is presumed that after soaking rains have fallen, the ants' normal requirements of germinating seeds are met and tobacco seedlings are consequently disregarded, or nearly so. Similarly, the principle that

ovi-position by Bagrada Bug (*Bagrada hilaris*, Burm.) is associated with dry ground appeared to be confirmed by the fact that, coincident with seriously delayed rains in Fort Victoria, this insect persisted in pest proportions through to February instead of disappearing as usual about November.

The following insects and their host plants or habits are worthy of record. Some of the notes are the result of observations made during the year, and others are records held over from previous years pending authoritative identification of the insects concerned:—

Hemiptera. A species of scale insect (*Odonaspis ruthae*, Kot.) was taken from the roots of Elliot grass, which is a fine variety of *Cynodon dactylon*, in a bowling green.

Several host plants of *Orthezia insignis*, Douglas, on which this pest has not apparently been previously recorded in the Colony were reported during the year. These include Tea, Scabious, Golden Rod, Xerophyllum, Duranta and Petrea.

Hilda patruelis, Stal., a Tettigometrid, was found commonly on the stems or roots of sunn hemp, peanuts, and haricot and other bean plants.

A species of *Acacia* (Leguminosae) and one of *Heeria* (Anacardiaceae) were found to be functioning as "rain trees" in Salisbury in October before the onset of the seasonal rains, the species of insect secreting the "rain" being the Cercopid (*Ptyelus grossus*, Stal.). The "precipitation" was sufficient to bring up weeds under the trees, none being present under uninfested trees.

Coleoptera. Adult Dynastid beetles reported to be entering potato stems underground and tunnelling upwards have been identified as *Heteronychus arator*, F.

A Rutelid beetle, adults of which were reported in 1946 to be preventing the blossoming of carnations by removing the petals in the fully developed buds at night, has been identified as *Anomala exitialis*, Per.

Two species of beetles, namely, a Phalaerid (*Phalaerus*, possibly *cervus*, Champ.) and a Cryptophagid (*Leucohimatium elongatum*, Er.), were found in April in large numbers at smut fungi on sugar cane.

Adults of a Cantharid beetle (*Mylabris decimata*, Bert.) were submitted by the Government Analyst for identification in connection with a native poisoning case.

A common species of Bostrychid borer (*Apate monachus*, F.) was found in October to have bored into the stems and branches of three-year-old avocado trees, which had to be pruned down very severely in order to encourage new shoots to be thrown out from the main stem. Adults of the same species were found in tunnels in stems of cotton in November, and of coffee in December.

There was a heavy infestation by a Cucujid (*Laemophlaeus pusillus*, Schon.) in quantities of *Panicum makarikari* seed.

Lepidoptera. The False Codling Moth (*Argyroploce leucotreta*, Meyrick) (Tortricidae), and a Pyralid (*Myelois ceratoniae*, Zeller), were bred from acorns imported from the Union of South Africa. *Argyroploce peltastica*, Meyrick, a relative of the False Codling, was reared from litchi fruits and from the seed-pods of *Elephantorrhiza suffruticosa*, an indigenous plant.

An abnormally large south-westerly migration of butterflies was seen in and around Salisbury in December, 1947. First reported on the 12th, the migration continued almost to the end of December. From the 12th to the 15th the swarms were particularly dense about midday, and, at least eastwards of Salisbury, were found to extend for over 100 miles. The species concerned was almost entirely *Catopsilia florella*, F., interspersed with a few *Phalantha aethiopica*, R. & J.

The Insect Collection. About 170 species of insects were identified during the past year by the Imperial Institute of Entomology. These were in the Orders Orthoptera, Hemiptera, Coleoptera, Hymenoptera, and Diptera. Some were also determined for the collection through the kindness of private collectors and the National Museum, Bulawayo.

TSETSE FLY.

General. Satisfactory progress against *Glossina morsitans*, Westw., continued in all of the northern tsetse fly areas of the Colony. No general advance of the protective barrier of operations has been attempted since 1940. Within this barrier belt, the shooting of game has been continued, and there have been further decreases in fly densities.

No operations are being carried out in the Zambesi Valley between the Rekomitje and Angwa Rivers, north of the escarpment, and it has been agreed between the various officers concerned in the Department that no permits to shoot game in the area will be issued. There is no real game sanctuary in this portion of the Colony and the game is being strictly preserved for possible permanent protection. Such protection would need to be effected either despite the presence of tsetse fly or with the help of future, but as yet unproved, methods of fly elimination. A similar area might be provided north of the escarpment in the Sebungwe District.

More definite steps have been taken for the creation of a national park or game reserve in the south of the Colony. This is expected to extend along the Limpopo River for about 70 miles on the westerly portion of the river in Southern Rhodesia. It would thus be continuous with the Dongola Game Reserve or Jan Smuts Wild Life Sanctuary in the Union of South Africa. Any threat of pressure of tsetse fly which might come from the east will be recognised in sufficient time to take whatever measures against the approach of fly as are known at the time to be most effective and practicable.

The other large game reserve of the country is the Wankie Game Reserve, considerable extensions of which have been re-

commended by the Southern Rhodesia Trypanosomiasis Committee. The site of this reserve was advised by the Chief Entomologist in office in 1927, who later fought and drove back from the reserve a south-westerly advance of *G. morsitans*. To-day the position is that the fly has been driven out of the Wankie and Bubi districts away from the Reserve, and ground has been gained from it in the Sebungwe district.

An area including the southern and south-western parts of the Sebungwe district itself and adjoining portions of the Bubi and Wankie districts has, in fact, become a haven of refuge for many thousands of hungry and thirsty cattle from the drought-stricken districts to the south and south-east. New cattle dipping tanks have been constructed by the Cold Storage Commission. The cattle are mainly on the Gwaai, Shangani, Kana and Mzola Rivers.

At the present time, certain coal measures in the Sebungwe district are being investigated with a view to immediate development. The area concerned is in country infested with *G. morsitans*, not far beyond our game destruction barrier, and it is anticipated that the development of the area will make an advance in our lines desirable. Already, representations have been made to us by cattle interests for protection from possible carried fly from the area. An agricultural survey party, including officers of the Department, representatives of the Natural Resources Board, and a farmer, carried out a preliminary survey of the southern portion of the district during the winter. Among recommendations of the party concerning the use of the land was a recommendation that the line of tsetse fly operations be pushed forward in order to make the area suitable for settlement and development.

On the Eastern Border, the threat to the Mtoko district continues, and eight cases of animal trypanosomiasis have been diagnosed from cattle. No fly has yet been discovered, but the indications are that the vector is either *G. morsitans* or *G. pallidipes*. In the Chipinga area of the Eastern Border the position continues to improve, the number of cases of animal trypanosomiasis apparently transmitted by *G. pallidipes*, *G. brevipalpis*, or possibly flies other than tsetse having been once more reduced.

Further south, in the Sabi area, no improvement can be claimed, fly being established in Portuguese East Africa, and pressing on our border.

Cases of human trypanosomiasis or sleeping sickness numbered 10 natives, as against 13 in 1946. One death resulted. It should be noted that, with one doubtful exception, no cases could be found to have been contracted within any past or present area of anti-tsetse game destruction.

The total length of road wholly or partly constructed and maintained by tsetse fly operations or through its vote is in the neighbourhood of 475 miles. As reclaimed land is settled, the roads included are taken over by the appropriate department or council for public use.

Conferences and Committees. Three meetings, including one comprehensive sub-committee meeting of the inter-departmental Southern Rhodesia Trypanosomiasis Committee, were attended. The discussions of the Committee included the fate of Eastern Border cattle, the possible ecological effects of early grass burning in relation to a threatened invasion by *G. morsitans* or *G. pallidipes* into the Mtoko district, the situation regarding animal trypanosomiasis in that district, the classification and nomenclature of vegetation types, the Sabi-Limpopo area of Portuguese East Africa, traffic control, the establishment of a sterile immunity to trypanosomiasis in cattle, attempts to obtain staff for the study of the use of modern insecticides against tsetse flies, the Zululand D.D.T. experiments against tsetse flies, the opening up of the Sebungwe district, and the proposed extension of the South African Dongola Game Reserve into Southern Rhodesia. Mr. H. E. Hornby, O.B.E., formerly Director of Tsetse Research, Tanganyika, resumed his place on the Committee after making extended investigations in Portuguese East Africa on behalf of the Portuguese Government.

At the invitation of the Union Government, the Chief Entomologist visited the large-scale experimental operations in Zululand, which include the extensive use of D.D.T. against tsetse fly, chiefly *G. pallidipes*. He returned well informed on all aspects of the work, including the results up to the time of his visit in July. Contact is being maintained with the Union authorities on developments. Related experiments by other large organisations elsewhere are being watched.

Destruction of Game. The policy of controlling *G. morsitans* by game destruction continues. It was supported as being effective against *G. morsitans* by the East and Central African Fauna Conference held in Nairobi during May.

Because land reclaimed by this means is occupied by humans, and because a tendency of the fly is to spread to its former haunts, the policy must continue for the protection of the occupants until a less undesirable method known to be equally effective in local application against the same fly can replace it. The cessation of game destruction within our barrier belt without applying a reliable alternative would be disastrous. Charges that the game of the country is being shot out by tsetse fly operations are, of course, founded on a false impression and are absurd.

The number of head of game destroyed has been considerably reduced. This is due partly to a temporary shortage of Martini Henry 0.45 ammunition, and partly to the decision that the time had arrived when smaller game could safely be spared. The small species of buck not now being destroyed are steinbuck, Sharpe's steinbuck, oribi, klipspringer, blue duiker and Livingstone's suni. Other game which is normally not destroyed on tsetse fly operations includes elephant, rhinoceros, hippopotamus, nyala, giraffe, and birds. The following exceptions are made in cases where *G. morsitans* is able to obtain sufficiently dependable meals from some of these animals, namely, elephant in the Sabi near the Portuguese East Africa border and in the Zambesi Valley in the Darwin and Doma areas: elephant and rhinoceros in a limited

portion of the Urungwe area; a very limited number of elephant in the Hartley district.

A total of 16,802 head of game was destroyed in all areas for an expenditure of 32,996 rounds of ammunition, or 1.96 rounds per head.

The amount of each species killed was:—

Elephant	8	Bushbuck	1,475
Rhinoceros	17	Duiker	3,262
Buffalo	276	Sharpe's Steinbuck	8
Zebra	150	Oribi	25
Eland	274	Warthog	2,848
Kudu	3,277	Bushpig	557
Roan Antelope	166	Baboon	1,072
Sable Antelope	917	Lion	3
Hartebeeste	96	Leopard	17
Tsessebe	69	Hyaena	14
Impala	1,161	Wild Dog	10
Waterbuck	323	Jackal	1
Reedbuck	776		

SHORT SURVEY OF THE TSETSE FLY OPERATIONS BY DISTRICTS.

Darwin. There is little to report from the Darwin area except a progressive reduction in fly densities along the Umsengedzi and Kadzi Rivers. Fairly dense fly (*G. morsitans*) is present in Portuguese East Africa at the junction of the Umsengedzi and Umkumbura Rivers, and light fly along the Umkumbura River for several miles above the junction. Fly is still present at the Sowe Salt Pan, the Dombatuli Pan, on the Kadzarui River, and on the Utete River west of the Kadzarui.

In addition to cattle at Kaitano's Kraal, on the Massingwa River, cattle are being introduced into the Chiswite Native Reserve. Altogether about 200 head are present in Chief Kaitano's country, around the Massingwa River, and in the foothills of the Mavuradona Range.

Lomagundi (Doma). The Doma area is an extension of the Darwin area westwards as far as the Angwa River. Here in the Zambesi Valley, fly (*G. morsitans*) is still dense on the Angwa and there is light fly on the Hunyani, Dande and Ambi Rivers. There has been a progressive reduction in fly densities over the whole area, except close to the Angwa River.

The main camp is to be moved from Doma to a site below the escarpment, on the Hunyani River, a little north of Mashunganyendi Pool, if the transport of supplies can be arranged. This move is considered necessary in view of the recession of fly northwards, and has been made practicable by the construction of a new road.

In the Doma block, an area which used to be included between game fences, several farms are now settled by Europeans and cattle are running freely. No cases of nagana have been reported and no fly have been seen south of the escarpment.

A new road runs from Sipolilo down the escarpment along the east banks of the Ambi and Hunyani Rivers to the P.E.A. border, with a branch running to Umsengedzi Mission, in the Mount Darwin area; a road has been constructed from the proposed new camp site below Mashunganyendi Pool to join this road. It has not yet proved necessary to erect a cleansing chamber on the road which gives access to the Zambesi Valley.

Urungwe. *G. morsitans* is fairly dense north of the escarpment in the Urungwe area, and is present in small numbers on all rivers running into the Sanyati north of the Tengwe River.

Despite the number of permits issued for the destruction of elephant and rhinoceros, these animals are still fairly numerous north and west of the Urungwe Native Reserve.

The number of cattle present in the Urungwe Native Reserve totalled 5,040, representing a slight increase during the year. No cases of animal trypanosomiasis have been reported in the Reserve, in the Karoi Settlement, or, in fact, anywhere in the area.

Chirundu. Small numbers of *G. morsitans* persist along the main road from Makuti to Chirundu. Shooting is confined to a belt five miles wide on each side of the road. The purpose is to keep the numbers of tsetse down so that the chance of their being transported along the road is reduced.

Lomagundi, S.-W. There have been further progressive gains in this *morsitans* area. No fly has been found north of the Umfuli or east of the Sanyati Rivers, and fly has been almost cleared in the area between the Sanyati River and the eastern boundary of the Sebungwe Native Reserve. If the present position is maintained, and further land is required for native settlement, the main camp at the junction of the Umfuli and Umniati Rivers may need to be abandoned within the next 18 months and a new camp established considerably to the west in the Sebungwe district.

Qualified permission has been given for a small number of cattle to be taken to the Emerald Mine. Their progress will serve as a useful index to the completeness of fly control in this area.

The road to the main camp is now in very bad condition, being used by traffic other than tsetse fly rangers. The Birthday Gift and the old Karandi and other mines west of the Umniati are still being worked.

Hartley. The Hartley area has now been almost completely cleared of fly (*G. morsitans*). East of the Umniati River a total of five flies has been reported as having been seen by natives during the year in the area around Ruswingo Vlei, but none have been caught, nor were any seen by the European ranger. Moreover, west of the Umniati River fly have probably been driven back to the edge of the Mafungabusi Plateau, and certainly as far as the headwaters of the Ungwe River. Thus in this area and the Lomagundi S.-W. area probably 500 square miles have been cleared in the Sebungwe district west of the Umniati and Sanyati Rivers, in addition to the large areas east of these rivers.

Running on Crown Lands in the area of the old game fences, which included most of the Yabongwe River and the country down to Gambiza's and Chidekideki's Kraals to the Umfuli River, there are now 526 head of native-owned cattle.

The main camp at Renje, on the Umniati, may also have to be moved, as it is now no longer well situated in the fly area.

Sebungwe. During the year only one fly was caught on the Mzola River. This was almost certainly a carried fly, as there is no known established fly focus nearer than the north end of the Matobolo Flats and on the Nagupande River at the drift. Even here, *G. morsitans* is present only in low densities. Otherwise, the area south of the Mkulugusi belt is free from fly. *G. morsitans* also persists at Chibira, Muzaza Hill, and is present in greater numbers on the northern edges of the present shooting area on the Sengwa and Lutope Rivers, at Tiwuli and Zamba.

In former shooting zones cleared of fly, game is now increasing on the Kana, Shangani and Gwaai Rivers. Owing to the drought, additional game has trekked down to the Gwaai for water.

As a measure to counter the drought, cattle were placed by the Cold Storage Commission on the Gwaai, Shangani, Kana and Mzola Rivers. As many as fifteen to twenty thousand head were placed there, but these now appear to have been reduced to five or ten thousand owing to use or return to restored grazing facilities elsewhere. It is of interest to note that natives have taken about 35 head of cattle to Pashu's Kraal, on the Manyande River, where there have probably been no cattle since 1913.

No cases of trypanosomiasis were reported from any of the cattle introduced into the above areas.

North of Gokwe, about 200 head of cattle are present on the Zambesi down to Tshete, and 413 elsewhere. There is no definite information available concerning losses due to fly in these cattle, but the number does not appear to be increasing.

Both natives and Europeans have applied to take cattle on to the Matobolo Flats, which, themselves being open and fly-free, appear at first sight suitable. Since, however, fly are present in the mopane bush bordering the flats to the north, settlement with cattle would still be dangerous. In May, a preliminary ecological and botanical reconnaissance survey of the area was made, and as a result, it was recommended that fly should be driven north to the escarpment and that the agricultural and pastoral value of the area should be further investigated.

No further information has come to hand concerning the occurrence of *G. pallidipes* in the Sebungwe district, but a survey is planned to take place in 1948.

At present the coal measures north of the main camp are being opened up, and an air strip has been made nearby. Game and tsetse are plentiful here. If this area is to be fully developed, tsetse fly operations will need to be extended northward to the escarpment.

The year 1947 has seen the cattle industry make the maximum use of areas reclaimed from tsetse fly.

Mtoko. Eight cases of animal trypanosomiasis were diagnosed from several hundred slides taken from cattle in the Chikwizo Native Reserve. No tsetse flies have yet been found, but it is supposed that the disease was transmitted by either *G. morsitans* or *G. pallidipes* penetrating up the Ruenya River from Portuguese East Africa. Owing to lack of water elsewhere, it was impracticable to move the cattle from the danger zone. Affected animals were treated with Phenanthridinium. It may be necessary to extend operations to this area, and an ecological survey is to be made in 1948 to explore the position. The report of the survey made on the Portuguese side of the border in 1946 by Dr. Jacinto de Sousa and Mr. H. E. Hornby will be of value in this respect.

Umtali. There were no developments in the Umtali area, neither tsetse fly nor trypanosomiasis having been recorded.

Eastern Border (Chipinga). Thirty-five positive cases of animal trypanosomiasis were diagnosed, involving 9 farms, as compared with 54 on 18 farms in 1946. Progressive improvement has been maintained, the present number being the lowest since 1940.

During the year 130 tsetse were caught, mostly in traps, on or near the border clearing, compared with 59 in 1946. This rather large increase in the number of tsetse caught does not necessarily denote an increase in the number of tsetse present. Owing to a hessian shortage, many traps fell out of repair or out of use in 1946, but these were repaired and returned to use early in 1947.

Of these 130 flies, 6 were caught in Southern Rhodesia, namely, 1 *G. brevipalpis* and 5 *G. pallidipes*. Of the total number, 101 were *G. pallidipes*, 13 *G. brevipalpis*, and 16 *G. morsitans*. Fourteen of them were caught by man, but of these, 12 were *G. brevipalpis* caught on paths in Portuguese East Africa. This is to be expected, because the pronounced habit of resting on paths exhibited by this species would render its capture likely by the large numbers of natives who work on the clearing. As in 1946 only one example of the flies taken in Southern Rhodesia was taken on man. The remaining five were all caught in traps.

The main clearing was widened along its western edge on Pendragon, in the Chiredza Valley, and on Farfell and Gungunyana, and a thickly wooded kloof on Mayfield was cut out. Apart from this, extensive cutting of regrowth was carried out on the main and subsidiary clearings.

The whole of the main and subsidiary clearings was burnt during September, a good burn being obtained. As usual, the forests of Mount Silinda and Chipete were effectively protected by fire-guards.

Sabi Valley. The position in the Sabi Valley remains unchanged. There is still a heavy concentration of *G. morsitans* in Portuguese East Africa about the Ndanga River. Occasionally

fly reach the Honde Dip from here. Altogether 846 fly were caught during patrols in the area, all but a few being across the border in Portuguese East Africa.

Cattle in the neighbouring Muumbe Dip area were seriously threatened by an invasion of fly from across the border, and as they could not be moved, an attempt was made to give them some protection by adding a fairly strong D.D.T. emulsion to the arsenical dipping fluid to utilise the residual effect of D.D.T. on tsetse flies. Emulsion was added to give a concentration of 0.85 per cent. *para para* D.D.T. At this concentration, however, certain of the ingredients of the emulsion caused an apparent scalding and a violent reaction resulting in temporary paralysis of the hind-quarters, and after two subsequent attempts, the project was abandoned.

Further south, on the Sabi below its junction with the Lundi, and again in Portuguese East Africa, fly is plentiful on the northern bank. During a patrol of the southern bank for 30 miles into Portuguese East Africa no fly was seen. Nevertheless, of a number of blood-smears taken from cattle, which are evenly distributed along this bank, one, at about 25 miles, showed the presence of *Trypanosoma congolense*. In general, the cattle were in only moderate condition.

The cattle removed late in 1946 from the Honde Dip to Chizambanje's Kraal to avoid contact with tsetse have thrived there, and no further cases of trypanosomiasis have been found among them.

The remainder of Chief Mahenya's cattle which were moved from his kraal to the region of the Hippo Mine in 1946 have now been sold for immediate slaughter. Occasional fly are still seen in Mahenya's area. At Chitsa's Kraal, in the Ndanga district, across the Sabi River from Mayenya's, two cases of animal trypanosomiasis were recorded early in the year. It was therefore decided to resume shooting in a triangle in the south-east corner of the Ndanga district, where game destruction had been suspended since 1945, in order to assist the Veterinary Department in controlling an outbreak of foot and mouth disease further to the north-west.

The prevention of the spread of *G. morsitans* from Portuguese East Africa into that portion of the Sabi Valley which is within the Colony will need to be all the more tenaciously prosecuted in view of the proposed Sabi Development Scheme. The firm of engineers investigating the scheme has been told that the valley can be kept free of *G. morsitans* at least to within a few miles of the Portuguese border by a maintenance or intensification of our operations.

TRAFFIC CONTROL.

The number of traffic cleansing stations and pickets remains the same, all being situated in the Urungwe district. No marked change has occurred in the number of fly being caught at each examination point.

The following traffic was examined at these stations:—

(a) **Vuti Chamber.**

1,922 motor cars bringing	14 fly (8 male, 6 female)
1,259 pedestrians, 216 cyclists (544 parties) bringing	6 fly (4 male, 2 female)
Total	20 fly (12 male, 8 female)

Compared with 1932 (106); 1933 (94); 1934 (178); 1935 (454); 1936 (519); 1937 (241); 1938 (162); 1939 (62); 1940 (25); 1941 (67); 1942 (49); 1943 (56); 1944 (27); 1945 (29); 1946 (23).

(b) **Catkin Chamber.**

455 motor cars bringing . . .	18 fly (16 male, 2 female)
911 pedestrians, 372 cyclists (665 parties) bringing	10 fly (7 male, 3 female)
Total	28 fly (23 male, 5 female)

Compared with 1944 (5 months only, 15); 1945 (61); 1946 (37).

(c) **Makuti Gate.**

1,944 motor cars bringing .	428 fly (297 male, 131 female)
1,412 pedestrians, 280 cyclists (708 parties) bringing .	336 fly (253 male, 83 female)
Total	764 fly (550 male, 214 female)

Compared with 1944 (4 months only, 100); 1945 (562); 1946 (703).

(d) **Chirundu Gate.**

1,532 motor cars bringing .	139 fly (97 male, 42 female)
1,587 pedestrians (266 parties) bringing	72 fly (50 male, 22 female)
Total	211 fly (147 male, 64 female)

Compared with 1940 (360); 1941 (119); 1942 (276); 1943 (746); 1944 (437); 1945 (485); 1946 (incomplete, 319).

ADMINISTRATIVE

Plant Regulatory Board. Two meetings of the Plant Regulatory Board were held, one being specially augmented to include departments not represented on the Board but interested in a proposed new "Fertilisers, Farm Feeds, Seeds and Pest Remedies Bill." Subjects discussed included:—

1. The importation of seed potatoes from overseas.
2. The importation of tubers and bulbs from overseas.
3. Importation of seed potatoes from the Union of South Africa.
4. Importation of dahlia tubers from Holland.
5. Proposed Fertilisers, Farm Feeds, Seeds and Pest Remedies Bill.

6. Black Spot on citrus in South Africa.
7. Importation of citrus fruit and peel for religious rites.
8. Proposed Agricultural Produce Grading and Marketing Bill.
9. Importation of *Opuntia* from the Union of South Africa.
10. Plant Inspection, Umtali.
11. Importation of sugar cane cuttings from Portuguese East Africa.

Plant Protection Act, 1942. The only new regulation published in terms of the Act was framed on the recommendation of the Senior Plant Pathologist to include suitable certification regarding freedom of potato tubers imported from overseas from Tomato Spotted Wilt (*Lycopersicum virus* 3) and a tolerance of three per cent of other serious virus diseases, including Leaf Roll, Streak, and all forms of severe Mosaic. This certification is now required in addition to the usual certification regarding Wart Disease (*Synchitrium endobioticum*) and regarding the origin of the crop.

Plant Import Regulations, 1943. A notice informing the public of the restrictions under which the importation of dahlia tubers may be imported into the Colony, and of prohibitions against certain such imports, was published in the Press.

The numbers of consignments and packages of plants, fruit, etc., examined at the ports of entry were as follows, the figures in parentheses being those for 1946:—

Port.	Packages.	Consignments.
Salisbury	112,685 (99,409)	6,086 (6,150)
Bulawayo	368,277 (239,851)	12,382 (11,507)
Umtali	13,479 (20,580)	3,695 (3,814)
Gwelo	3,207 (1,573)	704 (490)
Plumtree	2,136 (2,021)	180 (148)
Beitbridge	12 (219)	3 (19)
Total	499,796 (363,653)	23,050 (22,128)

The Umtali figures are exclusive of the 8,341 packages in 506 consignments for Umtali examined in transit at Bulawayo, and the Gwelo figures similarly do not include 9,279 packages in 770 consignments.

The fact that the 37 per cent. increase in the number of packages imported is represented by an increase of only four per cent. in the number of consignments is accounted for by the importation from the Union of South Africa of large consignments of packaged fruit for sale in the Municipal Markets at Bulawayo and Salisbury, and large consignments of small bags of potatoes.

Several hundred trays or boxes of pome and stone fruits were either returned to the Union of South Africa or destroyed, according to the degree of development of the larvae of the Codling Moth (*Enarmonia pomonella*, L.); with which the fruit was infested. Several hundred others in which the infestation was

less than five per cent. were sorted and released with the uninfested fruit. Consignments of carnations badly infested with the Carnation Caterpillar (*Epichorista ionophela*, Meyr.) were either returned to the Union or destroyed. A considerable weight of tomato seed in several consignments, and some maize seed, were returned to their overseas countries of origin or destroyed because covering phytosanitary certificates were either not produced or were not sufficiently specific to merit acceptance as fulfilling requirements. Prohibited peach seeds from overseas were destroyed on arrival by post. A considerable quantity of potatoes from the Union of South Africa was rejected or destroyed on account of infestation by eelworm or root knot nematode (*Heterodera marioni*, Goodey), and a number of bags of sweet potatoes from the same country was destroyed on account of a heavy infestation by the Sweet Potato Weevil (*Cylas formicarius*, F.).

A number of dahlia tubers, mostly small consignments, was destroyed on arrival or returned to the senders, as they were either prohibited or not covered by suitable certificates. Imported consignments grown in quarantine were later inspected by the staff of the Senior Plant Pathologist, and most of them were released. However, in several cases the presence of Tomato Spotted Wilt virus was suspected, and tubers were collected for further investigation.

The numbers of special permits issued for the importation of individual consignments of plants, and of annual permits issued to approved nurserymen in the Union of South Africa for the introduction of their stock, are given below, the figures in parentheses being those for 1946:--

Special Permits	709 (638)
Annual Permits	92 (76)

The increase in the number of special permits is merely a continuation of the post-war increase recorded in 1946. The increase in annual permits is probably the reflection of a desire of a greater number of Union nurserymen to avail themselves of the privileges which, subject to the receipt of favourable reports from the South African Plant Regulatory Service, we offer.

Nursery Regulations, 1943.

No. of Nurseries Registered	30 (25)
No. of Inspections made	28 (24)

There was no occasion to place any nursery in quarantine. Few were troubled with any insect pests or diseases.

Tobacco Pest Regulations, 1943.

No. of Tobacco Removal Licences for 1947 . . .	2,295 (1,806)
No. of Inspections made .	264 (776)

Advertisements failed to attract suitable types of applicants for the additional posts of tobacco pest inspectors authorised, and for the greater part of the year there has been only one inspector, who has had to spend a considerable portion of his time at headquarters in Salisbury. The number of inspections is therefore low.

Regulations for the additional safeguarding of cured tobacco from infestation by insect pests have been drafted with the object of encouraging the early disposal of tobacco from premises, but it is not proposed to bring them into effect until such time as there are sufficient inspectors to enforce them.

Various irregularities reported as the result of the 264 inspections are tabulated below, and are expressed in units as a percentage of 264, a fraction being expressed as the next highest unit. The figures in parentheses represent the percentages for 1946, expressed in the same way and based on 776 inspections:—

Presence of	Moderate, %	Extensive %
Stored Tobacco Worm (*Ephestia elutella*, Hbn.)	Nil (Nil)	Nil (Nil)
Stored Tobacco Beetle (*Lasioderma serricorne*, F.)	1 (Nil)	Nil (1)
Old Waste Tobacco	15 (5)	2 (3)
Tobacco Re-growth, Volunteers, Old Plants, etc.	5 (8)	2 (1)
Unwanted Seed-bed Tobacco Plants ..	1 (4)	1 (Nil)
Tobacco Leaf Curl	Nil (Nil)	Nil (Nil)
Tobacco Whitefly (*Bemisia rhodesianenses*, Corb.)	2 (1)	Nil (Nil)
Tobacco Rosette	Nil (Nil)	Nil (Nil)
Kromnek	Nil (Nil)	Nil (Nil)

In addition to the irregularities tabulated, there were many premises on which a few re-growths could be found after the fixed date before which, by regulation, their destruction is required. There were also many premises in which small quantities of old waste tobacco had not been removed from crevices or fittings.

Injurious Substances and Animals Act. One permit was issued for the importation of foundation comb from overseas, local requirements presumably having been met as usual by importation from neighbouring countries whose own regulations are a sufficient safeguard against the importation of bee diseases. Applications for the importation of honey from overseas were refused, and of bees, satisfactorily discouraged.

Phytosanitary Certificates. The numbers of certificates of freedom of plants, etc., from insect pests and diseases issued to exporters were as follows:—

Salisbury	67	(144)
Bulawayo	17	(9)

The Investigation of the Grassland Problems of Southern Rhodesia

By R. R. STAPLES, Chief Pasture Research Officer.

Introduction. The importance of grassland in Southern Rhodesia cannot be too strongly stressed. Not only is the animal industry dependent to a very large extent on grass as the main source of feed for livestock, but the grass cover is also the first line of defence in the preservation of our soil and water resources and in maintaining or improving soil fertility.

Southern Rhodesia, with its short rainy season and long dry season, has a semi-arid climate. In countries with this type of climate, it is becoming increasingly evident that the problems of maintaining soil fertility *must* be solved if a permanent and flourishing agriculture is to be achieved. No lesser objective can satisfy our needs. As Lord Hailey, in his classical treatise, "An African Survey," tersely puts the problem in its right perspective: "A rising standard of living cannot be based on a falling level of soil fertility."

The part which pasture or grassland research can play in the solution of these vital problems facing Rhodesian agriculture is well emphasised by Dr. Pole Evans in his preface to "The Second Progress Report on Pasture Research in the Union of South Africa," published by the Government Printer, Pretoria, in 1940: "Few thought that pasture research could be of much benefit to the country as a whole, and many begrudged the little that was spent on it in comparison with other State services. Yet, it has remained for pasture research to point out our folly in the past and to indicate safer and sounder methods of approach for the future.

"Pasture research has brought home in no uncertain manner the need for increasing and maintaining the natural fertility of our soils in every sphere of agriculture, and no better methods of doing this are available in semi-arid countries than through the medium of grass and the animal factor. It is an extraordinary state of affairs, and one for serious consideration and prompt action, that in our country with over 55 million head of stock, essential animal manure to be returned to the land should be practically non-existent.

"Grass is therefore the most important natural product that the country can possess. Grass restores natural fertility to the soil more quickly and more effectively than any other form of vegetation. Grass maintains the fertility of the soil longer than any other crop. Grass creates structure in soil more effectively than other plant growth, and thereby renders it less liable to erosion than is the case under any other form of plant cover.

"Grass is the cheapest and most valuable source of food that the earth produces. It is the greatest conserver of soil moisture and the most important builder of soil fertility that the world possesses. Man and nations have yet to learn this, although time and time again, great nations and powerful dynasties have fallen ahd disappeared through the neglect and destruction of their grass cover.

"The neglect of the grass cover spells declining soil fertility and a crumbling agriculture; then poverty, ill-health, disease, hunger, starvation and national disaster follow. These symptoms we see in South Africa to-day. The start made by the State to foster grass and pasture research is the most encouraging sign of the times, and is the most powerful weapon that could be forged to meet the oncoming national crisis.

"Pastoral research, if given full scope, holds the key to the preservation of our water and soil resources, the raising of our soil fertility, the revitalisation of our agriculture, the termination of the drift from country to town, the production of more wholesome food, the creation of a more healthy people and a more contented and vigorous nation. When the people know this and realise its importance in their lives and in the life of the nation, pasture research cannot be held back."

Organisation of Research. Grassland research of necessity is long-term research, as long-lived perennials, in the main, have to be investigated in contrast with annual plants in the usual crop production programme. Continuity in the work is essential, and in Southern Rhodesia a programme of research so comprehensive as to meet our needs can only be undertaken by the State.

The first organised attempts to carry out a grassland improvement research programme were sponsored from funds provided by the Empire Marketing Board on a pound for pound basis, and under the direction of the Chief Chemist (Mr. A. D. Husband), as a result of a scheme submitted by him in 1927. A comprehensive series of fertiliser experiments were laid down at the Grassland Experiment Station, Marandellas, and at the Matopos Experiment Station near Bulawayo in 1930. In view of the fact that the results of these experiments did not come up to expectations, the work was extended to include the supplementary feeding of minerals. Unfortunately, however, the work had hardly got under way when it was curtailed owing to the depression and financial debacle which followed.

Previous to this, as well as subsequently, numerous trials of indigenous and introduced pasture and fodder species were carried out at the Salisbury Experiment Station by the Chief Agriculturist's Branch. Trials were also carried out in co-operation with farmers and in a series of vleiland plots at Rusape in conjunction with the Farmers' Association there. These trials served a most useful purpose in exploring the field of pasture improvement by establishing more productive species. The information obtained has also served as a most useful basis for the further extension of the work.

The programme started at the Grassland Experiment Station, and partly financed by the Empire Marketing Board, was finally closed down in 1940. A Pasture Research Committee of the Department of Agriculture, under the Chairmanship of the Chief Animal Husbandry Officer (Dr. A. E. Romyn), was then formed to foster and guide pasture research activities in the Department, and in particular the extension on a field scale of grassland improvement on the Grassland Experiment Station, Marandellas. Appreciable progress was made in the improvement of the poor vleiland pasture and the assessment of the value of the improved pasture for milk and beef production. The low prices, however, which prevailed at that time for these products limited very severely the amount which could be expended economically by farmers on improvement of pasturage.

Meanwhile, a growing interest on the part of the farmers and general public in these all-important problems was awakening. Increasing interest was being taken in the conservation of our soil and water resources, in which, as already mentioned, the grass cover plays the key role. In these stages the Natural Resources Commission, and later the Natural Resources Board, played an active part. Finally, Dr. Pole Evans, Chief of the Division of Plant Industry of the Union, was commissioned in 1942 to report on the pasturage conditions in the Colony and to put forward concrete recommendations for the consideration and guidance of Government in this matter.

Dr. Pole Evans in his report stressed most strongly the importance of the grass cover in the future welfare of the Colony, the extensive damage already done to the natural pasturage, and the lack of adequate research to unravel and solve the country's grassland problems. He recommended an independent Institute of Pasture Research, adequately financed and staffed, as the most effective organisation to deal with the situation.

As the result of these recommendations and the publicity given them, the Government Ecologist, whose title was later changed to that of Chief Pasture Research Officer, was appointed towards the end of 1944 to the staff of the Department of Agriculture. The recommendation for the development of an independent Institute of Pasture Research was not accepted by the Government, as it was felt that the work should not be divorced from crop production on the one side and animal production on the other. Rather should the aim be team work on what is, after all, one complex problem—proper land usage.

The first task of the Chief Pasture Research Officer was to take stock of the position and to formulate a scheme of grassland research to serve the needs of the Colony. A reconnaissance survey was made and a scheme then drawn up for the development of two main stations, one at the Grassland Experiment Station, Marandellas, for the higher rainfall areas, and the other at Matopos, near Bulawayo, to serve the drier parts of the Colony. The problems of these two main areas differ very considerably. In addition, it was considered necessary to have six or seven substations, with smaller staff, to cover the major ecological areas in regard to soil, climate and vegetation. The scheme of research was considered and supported by the Pasture Research Committee of the Department and finally accepted.

Dr. William Davies, Director of the Grassland Improvement Station of the Ministry of Agriculture in the United Kingdom, a recognised authority on grassland improvement, was invited to visit the Colony in 1947 to obtain the benefit of his exceptionally wide experience in this field. In his report, published in this Journal in the November/December, 1947, number, he supported wholeheartedly the programme of work envisaged, but recommended a considerable strengthening of the research staff, and particularly a highly trained team to concentrate on the fundamental problems connected with ley pastures.

Development of the Two Central Stations. The first step in the development of the two Central Research Stations was the recruitment of suitably qualified and experienced officers to take charge of the stations. These officers were finally appointed in the middle of 1945, and later an Assistant Pasture Research Officer and two Technical Assistants were appointed to each station. Great difficulty has been experienced in obtaining men with the right training and background, a matter of especial importance in a small team of workers. Continuity in the work has also been adversely affected by resignations, four in number, to take up more lucrative employment. In 1946 a Pasture Research Chemist was appointed to the staff of the Chief Chemist, and is an essential member of the grassland team.

A well equipped grassland station requires a great deal of development before the actual research programme can be got under way. Staff quarters, office and laboratory accommodation, water supplies for domestic purposes and experimental animals, fencing, farm buildings, weigh-bridges, scientific equipment, all have to be provided, as well as detailed surveys for the lay-out of the experimental plots. Most of the building has had to be supervised by the staffs of the stations, partly to save expense and partly owing to the difficulty of obtaining contractors to undertake jobs in the country. The post-war acute shortage of materials of all descriptions caused many delays, but the more urgent necessities have now been provided.

Grassland Problems and Research Programmes. Full accounts of the research programmes for the two central stations, as well as that of the Pasture Research Chemist, follow later as separate reports, in which progress made in the various research projects is briefly indicated.

The programmes deal mainly with various aspects of the following problems:—

The Veld. Of the European farm land in the Colony, less than two per cent. is actually under cultivation. The rest is natural pasture or veld, and as far as can be foretold, by far the greater part, particularly in the low rainfall areas, will remain so. The importance, therefore, of its proper utilisation in order at least to maintain its productivity and protective cover to the soil, cannot be too strongly stressed. Hitherto, veld management has been almost entirely haphazard and subordinated to the welfare of the stock and general farm organisation. As the result, extensive damage has been done over wide areas; scrub and thorn bush encroachment is a serious problem in extensive areas; denudation and the thinning of the grass cover is taking place on an increasing scale, particularly in native areas, and in mixed veld the coarser and less desirable species are making headway.

There is no doubt that a drastic change in the treatment of the veld is required. The ideal to aim at would seem to be parkland, with useful trees and shrubs providing shade, some browse and pod feed of high protein content for the dry season, but, above all, a vigorous, dense grass cover. Before this ideal can be achieved, however, much painstaking research is required to provide the necessary information as to the best, and economic, technique. Information is particularly necessary on the role which mowing (where possible), burning and deferred grazing systems should play in the general plan. Fencing and increased watering points will be required, but unless these improvements are combined with the right systems of management, they frequently accelerate veld deterioration.

Especial attention is being given to all these problems at the Matopos Research Station. The relative role which veld, established pastures and fodder crops should play in farming systems is also an important feature of the work of this Station.

Established Pastures. On ploughable land in the better rainfall areas, there is little doubt that established pastures, including grass leys in cropping systems, will play an increasingly important part in farming practices. In these areas they should provide better quality feed, a longer grazing season, and a greater carrying capacity than the natural veld. The use of grass leys also offers promise of increasing crop yields.

A great deal of research of a high level, however, remains to be done before successful results can be relied upon. Too often in the past attempts on the part of the farmer have met with failures, or promising stands after a year or two have proved disappointing. High yielding species suited to the widely varying conditions of soil and climate have to be found and tested and easily established (preferably from seed) varieties selected or bred by the Plant Breeder. Of especial importance is the discovery of suitable pasture legumes to improve both quality of feed produced and levels of soil fertility. The Marandellas Research Station with its pasture sub-stations will pay particular attention to these important problems.

Vleiland Pastures. The extensive vleiland pastures of the better rainfall areas, and more particularly in the granite sandveld, provide special problems for research. Owing to their ability to retain moisture, often throughout the year, they offer considerable promise in providing succulent pasturage during the long dry season, when dry-land pastures are of little use for high-producing stock. The natural vlei grasses and sedges are usually of low palatability, and generally provide only a minimum of grazing in the early spring months after burning to get rid of the excess coarse, unpalatable growth. During the rains these vleis are normally too wet to graze, and stock at this time of the year definitely prefer dry-land pastures.

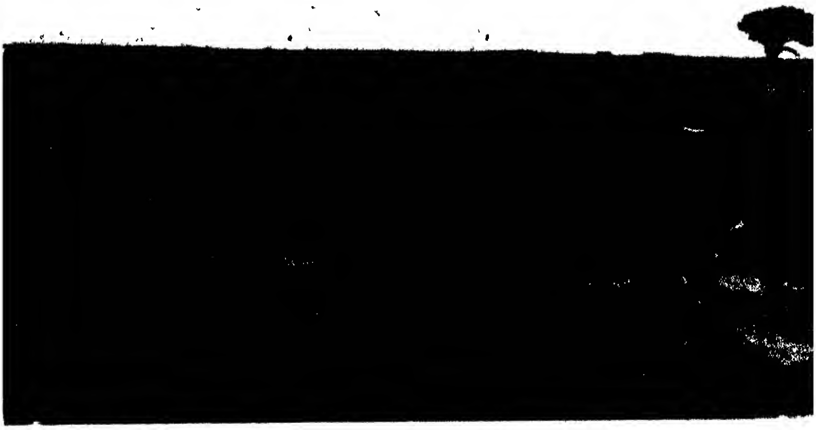
Much of this vleiland has been used in the past to grow very inferior crops of winter wheat. This practice apparently has led extensively to their drying out, and it appears, therefore, that this method of use cannot be justified. Their use as pasture land, on the other hand, provides some difficult problems. Not only is there the question of finding suitable species which will flourish under the adverse conditions of water-logging during the rains, but problems of low soil fertility, including possible minor element deficiencies, have to be solved. Their water relationship under intensive grazing conditions has also to be studied, as frequently these vleilands serve as "sponges" to permanent streams. These important problems are receiving intensive study, in co-operation with the Pasture Research Chemist, at the Marandellas Pasture Research Station.

Soil and Water Conservation. As already stressed, grass must play an important part in all conservation of soil and water projects. A grass sward is considered the most effective cover in protecting soil from eroding or washing under grazing conditions or as a ley in a cropping programme; it leaves the soil, after cultivation, in the best physical condition to absorb torrential downpours. There is also some reason to believe that a grass cover, of all permanent types of vegetation, is the most effective, in semi-arid areas, in maintaining stream-flow and ground water supplies. A clearer picture of these vital problems in regard to Rhodesian conditions, it is hoped will be obtained, as time and staff and materials permit, from investigations planned at the two main pasture research stations.

Surveys. In a well-balanced national scheme of grassland improvement, there are three distinct phases—survey, research and the application of research to actual farm practice. Surveys give the research worker a general picture of the problems of the area, their relative importance, the extent of the different veld types, and, of extreme importance, the vegetation changes which are being brought about by current farming methods. These surveys should and will largely influence the development of the research programmes of the stations, and are being carried out as time permits by the research staff, and particularly by the Chief Pasture Research Officer.

Detailed particulars of the research programmes and the progress so far achieved are given in the reports which follow.

Photo 1.—Typical Msasa tree-veld being cleared for experimental grazing areas.



Photos. 2 and 3: The type of cattle being used in the experiments. The paddocks have been cleared to parkland and the grass cover has started to thicken up, but is still very open.

Programme and Progress Report of the Marandellas Pasture Research Station

By J. M. RATTRAY, M.Sc., Pasture Research Officer.

Introduction. The Marandellas Pasture Research Station to serve Mashonaland is situated at an altitude of some 5,300 feet on the main Salisbury Umtali road, 3 miles west of the village of Marandellas and 45 miles from Salisbury. It falls within the 35 ins. to 40 ins. rainfall zone, and the soil is an acid granitic sand overlying a yellow clayey sub-soil. The vegetation is typical msasa tree-veld with a sparse grass cover on the dry-land areas and a dense association of sedges and grasses in the vlei areas.

Development. The first members of the staff to be appointed took up residence on the station in June, 1945, and after a comprehensive series of experimental projects had been drawn up, the necessary work to put this programme into operation was commenced. During the 2½ years of the station's existence, accommodation to house four European and two trained Africans has been provided, offices for the Pasture Research and Animal Husbandry Branches have been completed, and a fertiliser shed and store-room have been built. Five miles of road were constructed in this period, over 200 acres of tree-veld were thinned out to parkland, and six wells and a borehole were sunk. While this constructional work was in progress, suitable sites for the various experiments were selected, surveyed and fenced, and it has, up to the present, been possible to initiate more than half of the research projects.

EXPERIMENTAL SECTION

The Research Programme. The 24 experiments which form the main lines of investigation may be grouped under the following headings:-

1. Utilisation of Natural Veld.
2. Veld Burning Investigations.
3. Established Pastures.
4. Soil and Water Conservation.

1. **UTILISATION OF NATURAL VELD.** The natural veld which is under consideration for these studies falls into two main types:—

(a) The dry or topland regions characterised by msasa tree-veld; and

(b) The vlei areas in which trees are noticeably absent and the vegetal cover consists chiefly of sedges and grasses.

(a) *The Msasa Tree-Veld.* The dominant trees in this type of veld are Msasa (*Brachystegia spiciformis*) and Umnondo (*Isoberlinia globiflora*) distributed more or less equally (see photo). (This is particularly the case throughout the experimental grazing blocks.) Some 11 other species of trees (see footnote 1) are also represented, of which *Ochna* sp. (native name: Momenu), *Parinarium mobola* (native name: Muhasha) and *Protea* spp. (sugar bush) are probably the most common. The grass cover under the trees is sparse, but becomes denser in the more open areas and is characterised by a number of grass and legume species (see footnote 2)—the more important being several kinds of thatching grass, spear grass, Natal and Nyassa red-top, finger grasses, particularly the Milanji finger, upright false paspalum, one of the love grasses, and Vaalbush (*Eriosema englerianum*) and *Dolichos lupiniflorus* the two characteristic legumes.

(b) *The Vlei Vegetation.* Owing partly to the seasonal water-logging which takes place in these areas, trees are invariably absent except along the fringes, where the water-berry tree (*Eugenia* spp.) is often characteristic. On the drier margins russet-grass (*Loudetia simplex*) frequently forms a distinct zone, and in the damper areas oats grass (*Monocymbium ceresiiforme*) and snowflake grass (*Andropogon eucomis*) are common species. In the wettest parts sedges (mostly species of *Scleria*) predominate. Other grasses frequently encountered and often dominant in semi-damp (but not permanently wet) areas are species of *Aristida* (stick grass), *Eragrostis* (love grass) and *Brachiaria* (false paspalum).

The vlei vegetation is sour and unpalatable, particularly as it matures, and the problem of its correct utilisation is an important one. A common farming practice at present is to burn it immediately after the frosts have ended and to graze the young flush subsequently produced. This provides grazing for about 2½ months, but for the rest of the year the majority of vleis are comparatively useless, except in Native Reserves, where stock are forced to graze them throughout the summer months.

1. *Strychnos* spp. (Mutamba), *Ekebergia capensis* (Mvuranyima), *Burkea africana* (Mukarati), *Vangueria* sp. (Matufu), *Faurea speciosa* (Msasadi), *Cussonia* sp. (Mofenge), *Albizzia* sp. (chiefly *A. astunesiana*) (Moranyenge), *Heeria insignis* (Murungu).

2. *Hyparrhenia filipendula, H. Ruprechtii, Heteropogon contortus, Pogonarthria squarrosa, Trachypogon plumosus, Rhynchelytrum repens, R. nyassanum, R. setifolium, Digitaria milanjiana, D. Brazzae, Brachiaria brizantha* and *Eragrostis chalcantha.*

The experiments which have been designed to determine the correct utilisation of the veld may for convenience be grouped under two main headings:—

A. Veld grazing trials.

B. Veld management studies.

A. **VELD GRAZING TRIALS**. The question of how to provide grazing on a year-long basis with a minimum of supplementary feeding, particularly in high rainfall sour veld regions of Southern Rhodesia, constitutes a major problem in any cattle farming programme. The potentialities of the msasa tree-veld are not yet clearly understood, especially as regards the role that trees play in the tree-grassland association. Their removal undoubtedly allows a heavier growth of grass to take place, while their presence is desirable for providing shade and browse. It therefore seems necessary that some form of compromise should be aimed at in which a certain proportion of the trees are retained in the form of a parkland. In certain of the veld grazing experiments which are being carried out on this station over 200 acres of msasa tree-veld have already been thinned out to parkland containing 3-5 trees per acre, and rotational grazing trials are in progress on the veld so treated Other experiments to be commenced shortly have been designed to determine the optimum number of trees which may be left in order to obtain the maximum production of grass, and also the amount of browse material which trees and shrubs may be expected to provide during the critical months of late winter and early spring.

The principles of grazing management which should be applied to the parkland in order to ensure the maximum grazing capacity while maintaining the veld in good condition require to be thoroughly investigated, and this aspect is being studied in the following experiments: -

Grazing Management Trials on Msasa-Veld and Vlei-Land.

Object. To compare different all-year-round systems of controlled grazing with free-range grazing on msasa parkland.

Design.

Trial 1. A paddock of 90 acres, including 30 acres of vlei, grazed by 10 steers throughout the year on free range.

Trial 2. A 3-paddock rotational grazing system suitable for unmowable veld. This system actually involves 4 camps whereby three 20-acre topland camps are grazed rotationally during summer and one 30-acre vlei camp is brought in as additional winter grazing.

This area of 90 acres is grazed by 10 steers according to the following plan:—

Semi-dormant Season	1946-47	1947-48	1948-49
First greening to first good rain.	Camps Nos. 1-2-vlei-camp	Camps Nos. 2-3-vlei-camp	Camps Nos. 3-1-vlei
Growing Season.			
After first rains *burn.*	Camp No. 3	Camp No. 1	Camp No. 2
First good rain to piping stage (1).	" " 1	" " 2	" " 3
Piping stage to full flowering stage.	" " 2	" " 3	" " 1
Full flowering to seeding stage.	" " 3	" " 1	" " 2
Seeding stage to first frosts.	" " 1 then 2	" " 2 then 3	" " 3 then 1
Dormant Season.			
First frosts to first greening.	Camps Nos. 2-3-vlei-camp	Camps Nos. 1-3-vlei-camp	Camps Nos. 1-2-vlei-camp

(1) "Piping" refers to that stage in the growth of the grass where flower heads are beginning to protrude from the leaf sheaths.

Trial 3. A 3-paddock system of rotational grazing suitable for mowable veld similar in lay-out to Trial 2 but grazed according to the following plan:—

Semi-dormant Season	1946-47	1947-48	1948-49
First greening to first good rains.	Camps Nos. 1-2-vlei	Camps Nos. 2-3-vlei	Camps Nos. 3-1-vlei
Growing Season			
First good rains to piping stage.	Camp No. 1	Camp No. 2	Camp No. 3
Piping to full flowering stage.	" " 2	" " 3	" " 1
Full flowering stage, mow.	" " 3	" " 1	" " 2
Full flowering to seeding stage.	" " 1	" " 2	" " 3
Seeding to first frost.	" " 3	" " 1	" " 2
Dormant Season.			
First frost to first greening.	Camps Nos. 1-2-3-hay-vlei	Camps Nos. 1-2-3-hay-vlei	Camps Nos. 1-2-3-hay-vlei

N.B.—It has already become apparent that mowing a camp once in three years for hay will not keep Msasa coppice growth in check, and it has therefore been decided to carry out a cleaning-up operation by mowing the other two camps in October—the old grass to be used for bedding or compost.

> *Trial* 4. A 2-paddock system of rotational grazing on an area of 90 acres, of which 30 acres of vlei-land are fenced off from the rest, which is divided into two 30-acre camps. The stocking rate, as before, is 10 steers, and the paddocks are grazed alternately for one or two weeks at a time, depending on the rate of growth of the grass. In the early autumn one paddock is closed to grazing until winter, when both paddocks, plus the vlei-camp, are made available to the cattle. The camp, which is closed in autumn, is alternated every year.

These trials were commenced in December, 1946, with two-year-old steers mostly of the Sussex and Afrikander type. (See photographs 2 and 3.) The cattle were grouped according to weight, and the average of the 10 in each group varied from 558.1 lbs. to 559.3 lbs. at the commencement of the experiment.

The 1946-47 summer season started off favourably as far as the rains were concerned, but during the latter half, the rainfall was badly distributed in light precipitations, which had very little effect on the vegetation. This droughty period had a marked detrimental effect on the moisture in the vleis, with the result that in the following spring the early regrowth normally associated with the vleis did not take place until the usual summer rains had commenced. This set of conditions, together with the fact that the experimental area was virgin tree-veld thinned to park land and consequently possessed of a sparse grass cover, resulted in the complete depletion of the grazing by the end of July, and the cattle had to be removed from their respective camps to other grazing. They were returned to the vlei camps towards the end of October, but owing to the lateness of the spring flush in these areas coinciding with the new growth in the topland camps, they had to be transferred to these latter paddocks within a few days in order to keep this top flush down in the early stages. All the animals received a supplementary protein feed at an average rate of $1\frac{1}{2}$ lbs. per head per day during the period 7th July to the 24th October.

It will be noted that in the rotational systems described earlier, the changes from paddock to paddock are made according to whether the grass is piping, flowering or seeding. As the grassland is made up of numerous species which mature at different intervals, some being early grasses, some mid-season grasses and others late grasses, it was decided to use three of the common early flowering species as indicators. Spear-grass, Natal red top and one of the "love" grasses were accordingly selected, and the growth changes in these grasses have been followed as closely as possible. During the 1946-47 growing season this system worked comparatively well, but this season (1947-48) the new growth was produced so rapidly that it was virtually impossible to change the cattle according to the stage of maturity of the three indicator grasses, and at the same time keep the herbage reasonably well

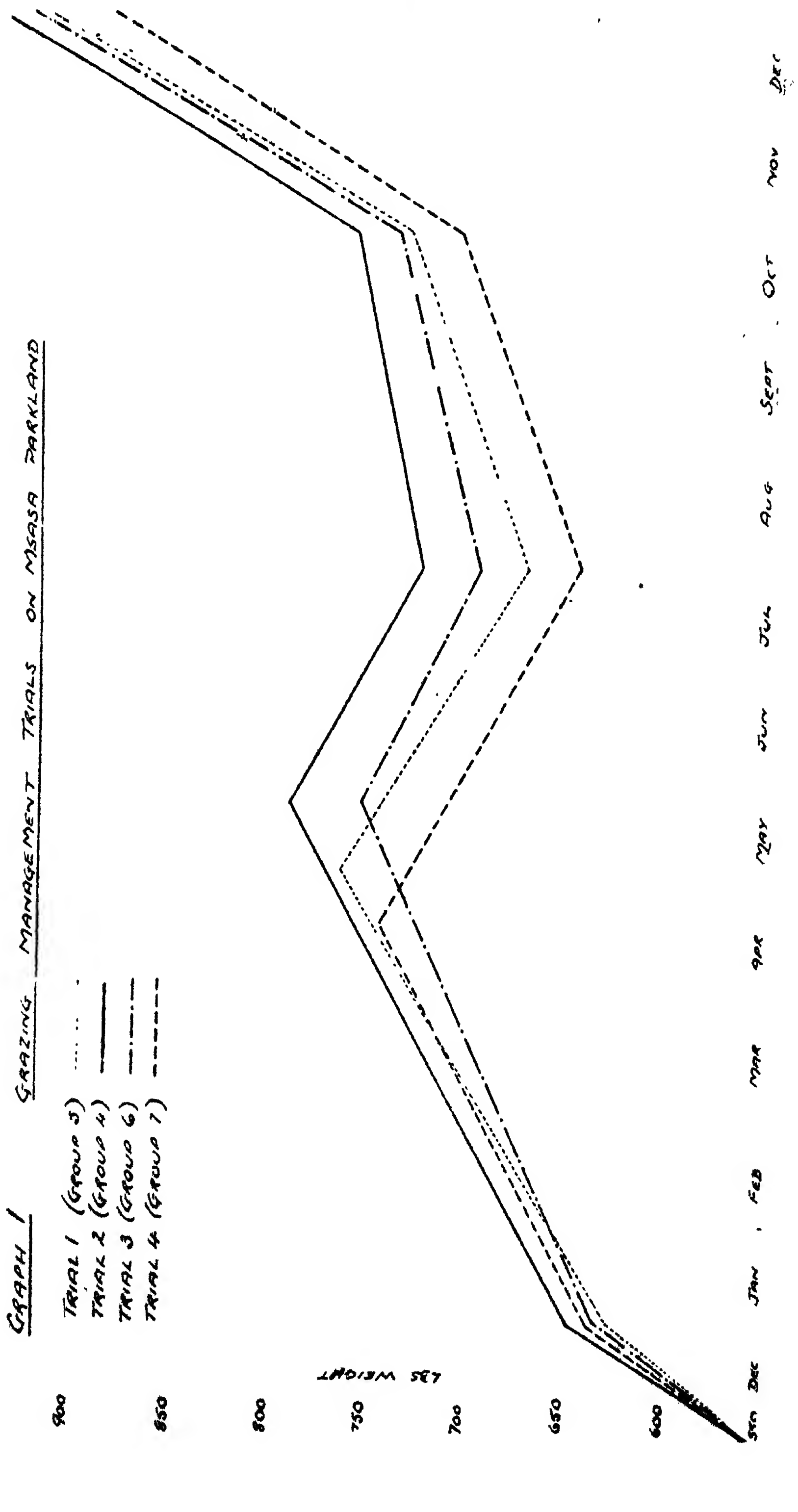
down in all three of the camps. The grazing plan was therefore modified, and although the camps have been grazed in the order laid down originally, the times of changing the cattle are not now governed by the stages of maturity of the three indicator grasses, but by the condition of the paddock as a whole.

The following table (Table 1) gives the average weights of the cattle groups in this experiment at different periods during the year December, 1946, to December, 1947:—

TABLE 1.

	Average weight (in lbs.) of cattle groups.			
	Trial 1.	Trial 2.	Trial 3.	Trial 4.
Average weight at commencement of experiment (4/12/46)	.558.1	559.3	558.5	558.1
Peak summer weight and dates when reached	6/5/47 769.9	24/5/47 795.4	24/5/47 759.2	22/4/47 748.6
Gain in weight from commencement to peak summer weight	211.8	236.1	200.7	190.5
Weight when removed from experimental area on 26/7/47	676.9	730.8	698.5	648.6
Loss in weight from peak summer weight to removal from experimental area	93.0	64.6	60.7	100.0
Weight at end of period of supplementary feeding and return to experimental area on 24/10/47	738.4	765.3	742.8	713.2
Gain in weight since reperiod of supplementary feeding	61.5	34.5	44.3	64.6
Weight on 27/12/47	940.9	959.7	943.3	903.0
Gain in weight since the commencement of experiment on 24/10/47	202.5	194.4	200.5	189.8

Graph 1 gives the weight curves of the four groups derived from the above table.


GRAPH I
GRAZING MANAGEMENT TRIALS ON MSASA PARKLAND
TRIAL 1 (GROUP 5)
TRIAL 2 (GROUP 4)
TRIAL 3 (GROUP 6)
TRIAL 4 (GROUP 7)
LBS WEIGHT
900
850
800
750
700
650
600
SEP
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEPT
OCT
NOV
DEC

Several points of interest may be noted from the weight figures:—

1. The cattle in Trials 2 and 3, which were grazed according to a 3-camp rotational system continued to make weight for nearly 3-5 weeks longer than the other two groups, and had lost least weight by the time the cattle were removed from the experimental paddocks.

2. The cattle in Trials 1 and 4, which lost the most weight before being removed from the experimental camps, gained more during the period of supplementary feeding than the other two groups.

3. The cattle in Trial 4 (2-camp rotational system) have not so far done as well as might be expected. They started to lose weight earlier than the other 3 groups and have up to the present consistently made the least gains on the available grazing.

The above remarks should only be regarded as preliminary observations, as it is obviously too early to draw any conclusions at this stage.

In order to assess the summer carrying capacity of Msasa veld grassland, three different intensities of grazing are being compared in the following experiment:—

Object. To investigate the effect of different intensities of grazing on grassland used as summer pastures.

Design.

Trial 1. 40 acres grazed by 10 steers (cattle group No. 1).

Trial 2. 60 acres grazed by 10 steers (cattle group No. 2).

Trial 3. 80 acres grazed by 10 steers (cattle group No. 3).

Management. The cattle are put on to graze these camps at the commencement of the growing season and left to graze them throughout the summer and part of autumn until they begin to lose weight.

This experiment was commenced on 4th December, 1946, and the cattle grazed the camps continuously until the 18th June, 1947. At this stage the animals in Trial 1 had lost an average of 47 lbs. and those in Trials 2 and 3 had lost 41 lbs., and they were then removed to other grazing according to plan. They were returned to the experimental camp on 29/10/47. All the groups reached their peak weight between the 10th and 17th May, when Group 1 had made an average gain of 264 lbs., Group 2 219 lbs., and Group 3 258.4 lbs.

Table 2 summarises the weights of these 3 groups during the period 4th December, 1946, to 18th June, 1947.

TABLE 2.

	Average weight (in lbs.) of cattle groups.		
	Trial 1.	Trial 2.	Trial 3.
Weight at commencement of experiment (4/12/47)	558.9	559.3	559.7
Peak summer weight and date when reached	17/5/47 823.1	17/5/47 779.1	10/5/47 818.1
Gain in weight from commencement to peak	264.2	219.8	258.4
Weight when removed from experimental camps	775.2	738.0	776.5
Loss in weight from peak summer weight to removal . . .	47.9	41.1	41.6

During the period the animals were out of the experimental areas, they received a supplementary protein ration at the rate of 1 lb. per head per day for 31 days and ½ lb. per head per day for 16 days, feeding only commencing on the 12th September.

Table 3 gives the weights of the groups during the period 18th June to 27th December, 1947.

TABLE 3.

	Average weight (in lbs.) of cattle groups.		
	Trial 1.	Trial 2.	Trial 3.
Weight when removed from experimental camps	775.2	738.0	776.5
Weight when protein supplement started (12/9/47)	696.8	667.1	698.3
Loss in weight from removal to commencement of supplementary protein ration	78.4	70.9	78.2
Loss in weight from peak summer weight to commencement of supplementary protein ration .	126.3	112.0	119.8
Weight when returned to experimental camp	695.0	672.3	710.9
Weight on 27/12/47	892.8	883.6	906.9
Gain in weight from commencement of experiment to end of year ..	197.8	211.3	196.0

From the weights of the animals and the condition of their respective camps, it appears that the correct grazing pressure was applied to the 40-acre camp, as it maintained a steady production of short grass throughout the growing season, and, by the time the cattle were removed, was evenly grazed right down without showing any signs of selective grazing. The 60-acre camp was just large enough to allow selective grazing to take place from the first flush, and coarse grasses which came away quickly were soon left untouched. This meant that from early summer the only grazeable areas of short, palatable grasses were those which the animals had selected earlier on, and these may not have been large enough to supply the cattle with sufficient bulk to make the same gains as those in the other two groups. The 80-acre camp was large enough to allow the animals to graze selectively and yet obtain enough grass to make the same gains as the group on the 40-acre camp.

It will be interesting to note whether the same weight curves are maintained throughout the present season, as up to the end of December all these groups were keeping well together. (See Graph No. 2.)

B. **VELD MANAGEMENT STUDIES.** In the preceding two experiments the condition of the grazing animal as well as the condition of the veld is being studied, while in the following veld management experiments the animal is only used as a defoliating agent, and the main object will be the study of the effects of the various treatments on the herbage.

Frequency and Duration of Rest Periods on Msasa-Veld Grassland.

Object. To investigate the value of rest at different times on the productivity of Msasa-veld grassland.

Design. Half-acre plots are to be treated as follows:—

Treatment 1. Grazed throughout the growing season every year.

Treatment 2. Grazed throughout the growing season for two years in three, mown for hay in the third year and the aftermath grazed in winter.

Treatment 3. Grazed as in Treatment 2, but mown every third year after frosts for compost-making.

Treatment 4. Grazed and mown in alternate seasons.

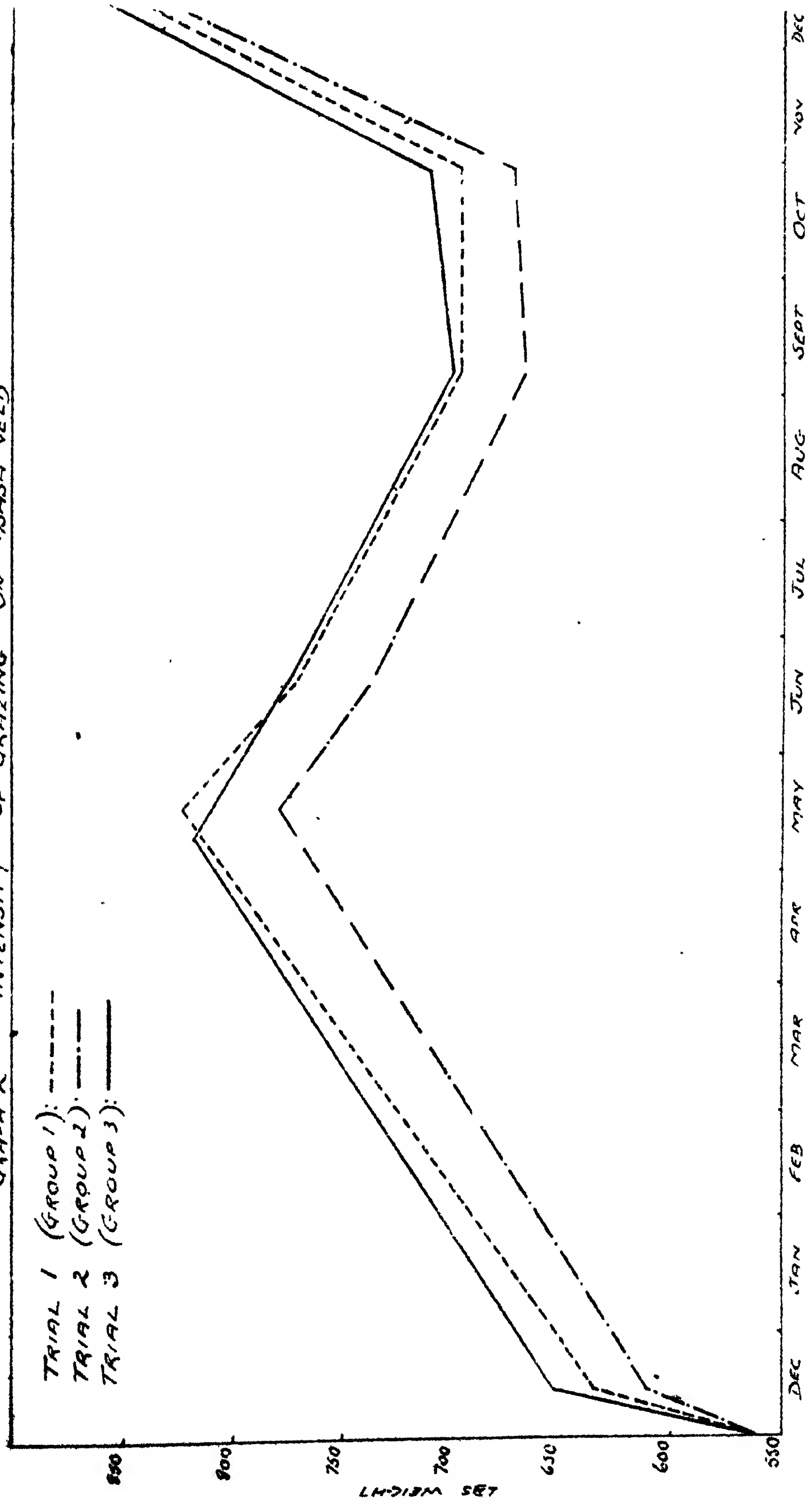
Treatment 5. Rested first half of active growing season every other year.

Treatment 6. Rested second half of active growing season every other year.

Treatment 7. Rested first half of active growing season every third year.

Treatment 8. Rested second half of active growing season every third year.

Treatment 9. Never grazed, but mown after frosts for compost-making.


GRAPH 2 INTENSITY OF GRAZING ON MSASA VELD
TRIAL 1 (GROUP 1)
TRIAL 2 (GROUP 2)
TRIAL 3 (GROUP 3)
850
800
750
700
650
600
550
LBS WEIGHT
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEPT
OCT
NOV
DEC

This experiment was commenced on 16th December, 1946, and the treatments have been carried out according to plan since then.

Effect of Mowing on Msasa-Veld Grassland.

Object. To determine the amount of mowing that may safely be carried out on Msasa-veld grassland and to study its effect on the vegetation.

Design. One-acre plots are to be treated as follows:—

Treatment 1. Mown each year at the hay stage.

Treatment 2. Mown every second year at the hay stage.

Treatment 3. Mown every third year at the hay stage.

Treatment 4. Mown in winter each year after frosts to remove old grass.

The aftermath in Treatments 1, 2 and 3 will be grazed in autumn; Treatments 2 and 3 are also intermittently grazed throughout the intervening season or seasons. Treatment 4 is never grazed, and acts as a control plot.

This experiment was commenced by cutting Treatments 1, 2 and 3 on the 27th February, 1947. The following yields of grass were obtained:—

TABLE 4.

Treatment No.	Yields of Hay in lbs. per Acre.
1	2,149
2	3,266
3	4,896

Growth Rate and Chemical Composition of Msasa-Veld Grassland.

Object. To study the growth rate and chemical composition of Msasa-veld grassland throughout the growing season.

Design. 44 small plots, 6 ft. x 6 ft., have been laid down in typical grassland, and different plots are cut monthly throughout the season to determine the growth rate, and the effect of frequency of cutting is determined by cutting certain other plots once, twice, three times and six times during the season.

This experiment is being conducted by the Pasture Research Chemist, and the results to date are included in a separate report.

The Liming of Natural Vlei Pastures.

Object. To study the effect of lime on the pH of the soil and herbage production of the natural vlei grassland.

Design. Half-acre plots are treated as follows:—

Treatment 1. No application of lime.

Treatment 2. 1,000 lbs. of agricultural lime per acre.

Treatment 3. 2,000 lbs. of agricultural lime per acre.

Treatment 4. 4,000 lbs. of agricultural lime per acre.

These plots are to be mown in late winter and grazed in spring.

Half-acre plots, 10 yds. x 242 yds., were marked off in a uniform piece of vlei-land and the lime was applied in January, 1947. Soil pH determinations were carried out by the Pasture Research Chemist on the various plots before the treatments were applied. The pH was found to range from 4.8 to 5.6, averaging 5.4. The determinations will be repeated from time to time in later years.

2. **VELD BURNING.** Although veld burning is a form of veld management, the problem is regarded as of such importance as to warrant a separate series of experiments.

The influence of burning on the natural vegetation is still a subject of much controversy, and the time and frequency of using fire as part of the system of veld management will form the main lines of investigation in the following series of experiments, which were all commenced in 1946:–

Time and Frequency of Burning Msasa-Veld Grassland.

Object. To study the effect of burning on the vegetation of cleared Msasa veld.

Design. One-acre plots are to be treated as follows:

Treatment 1. Not burned.

Treatment 2. Burned before frosts each year.

Treatment 3. Burned after frosts each year.

Treatment 4. Burned before frosts every second year.

Treatment 5. Burned after frosts every second year.

Treatment 6. Burned before frosts every third year.

Treatment 7. Burned after frosts every third year.

Treatment 8. Burned after first good rains every year.

Treatment 9. Burned after first good rains every second year.

Treatment 10. Burned after first good rains every third year.

This experiment is designed to investigate the effects of burning without the complication of grazing, and there is therefore no further treatment after burning. Botanical analyses of the vegetation on the plots are made at intervals to determine what changes, if any, are taking place in the herbage as regards density and individual constituents.

Time and Frequency of Burning Msasa-Veld Grassland in Relation to Grazing.

Object. To study the effects of combinations of burning and grazing on Msasa-veld grassland.

Design. Five-acre camps are treated as follows:—

Treatment 1. Burned annually at the end of winter after first good rains. Grazed from mid-summer onwards.

Treatment 2. Burned annually at the end of winter after first good rains. Grazed autumn and winter.

Treatment 3. Burned annually at the end of winter after first good rains. Grazed from first greening onwards.

Treatment 4. Burned annually mid-winter. Grazed from first greening onwards.

Treatment 5. Burned annually at the end of winter before first rains. Grazed from first greening onwards.

Treatment 6. Burned every two years at the end of winter after the first good rains.

1st Year. Grazed from mid-summer onwards.

2nd Year. Grazed in early summer.

Treatment 7. Burned every three years at the end of winter after first good rains.

1st Year. Grazed from mid-summer onwards.

2nd Year. Grazed in summer.

3rd Year. Grazed in spring and early summer.

Treatment 8. Burned every three years in mid-summer.

1st Year. Complete rest--neither burned nor grazed.

2nd Year. Burned in mid-summer. Grazed in winter.

3rd Year. Grazed from mid-summer onwards.

4th Year. Complete rest--neither burned nor grazed.

There is at present little to remark on in this experiment, except possibly the difference which appears to be showing up between Treatments 4 and 5. At the beginning of the 1946-47 season, the after-burn flush came away at the same time in both treatments as soon as rain had fallen, and the amount of grazing obtained was almost the same in both camps up to the end of January. Treatment 4, however, was eventually grazed for an extra 7 days in February. At the commencement of the 1947-48 season, although over an inch of rain fell two days after Treatment 5 was burned (15th September), the flush of new growth in this camp only became grazeable by the 17th November, whereas Treatment 4 had already been grazed from the 21st to the 29th October, and has so far this season carried cattle for a much longer period than Treatment 5.

It should be of interest to see what effect burning may eventually have on the leguminous shrubs, *Eriosema* and *Dolichos*, and also the Msasa coppice growth. These plants have usually commenced their new season's growth by the middle of July, so that the mid-winter burn (which has so far been carried out on the 11th July) is too early to affect the new growth, while the end-of-winter burn (middle of September) destroys it when it is already fairly well developed. The after-rain burns are carried out several weeks later than the end-of-winter burn, when the new shoots have become more woody, and thus more fire-resistant, and the effect of fire does not appear to be so harmful.

Time and Frequency of Burning Vlei-Lands in Relation to Grazing.

Object. To study the effects of combinations of burning and grazing on vlei-land vegetation.

Design. One-acre plots are treated as follows:—

Treatment 1. Burned annually at the beginning of July and grazed in August.

Treatment 2. Burned annually at the beginning of August and grazed in September

Treatment 3. Burned annually at the beginning of September and grazed in October.

Treatment 4. Burned every second year at the beginning of August and grazed in September.

Treatment 5. Burned every third year at the beginning of August and grazed in September.

Treatment 6. Burned annually at the beginning of August and grazed in October.

Treatment 7. Burned annually at the beginning of August and grazed in November.

Treatment 8. Never burned, but grazed, if possible

These plots are only grazed after burning according to the schedule during the intervening seasons, thus the plot in Treatment 4 has one year's rest from grazing and burning and the plot in Treatment 5 has two years' rest.

Botanical analyses will be carried out at intervals to determine changes in vegetation brought about by the various treatments. It is often claimed that burning results in a reduction of the organic matter content of the soil. To investigate this problem, soil samples were taken by the Pasture Research Chemist from a number of the plots for the determination of the organic carbon and nitrogen content of the soil. It is intended to repeat these determinations after the treatments have been applied for a number of years.

3. **ESTABLISHED PASTURES.** The possibility of establishing more productive pastures than the natural veld on dryland as well as the vlei areas, is an aspect of pasture research which requires a considerable amount of attention, particularly in view of the importance of dairying on the sandveld.

The responses of such pastures to various fertilisers and trace elements and their management in a year-long system of grazing requires careful study, while the effect that such pastures may have on soil fertility and structure as leys in crop rotations needs a thorough investigation.

The following experiments, which were commenced in 1946 and 1947, are intended to cover certain of these aspects, and further experiments will be laid down later.

Carrying Capacity of Couch Grass (*Cynodon dactylon*).

Object. To determine the carrying capacity of couch grass, particularly as a winter pasture.

Design. 24 acres of this grass were planted in late December, 1947, and, when well established, grazing will be carried out according to a plan to be worked out later.

Star Grass (*Cynodon plectostachyum*) Ley Pastures.

Object. To ascertain the part which this grass can play as a ley pasture in a crop rotation of four years, particularly in regard to its effect on soil fertility and structure. A suitable system of grazing management is also to be worked out.

Design. Nearly 200 acres of star grass have already been planted out by the Animal Husbandry Officer, and these will rotate with 200 acres of crops over a four-year period. It is hoped to be able to start with the grazing management system during the 1948-49 growing season.

The Fertiliser Requirements of an Established Upright Paspalum (*P. urvillei*) Pasture on Vlei-Land and its Effect on Beef Production.

Object. To determine the effects of fertiliser on an established pasture of paspalum and to study how far these requirements affect beef production.

Design. Four-acre camps are treated as follows:—

Treatment 1. Lime only.

Treatment 2. Lime + phosphate.

Treatment 3. Lime + nitrogen.

Treatment 4. Lime + phosphate + nitrogen.

Treatment 5. Lime + phosphate + nitrogen + potash.

Treatment 6. 3 X (lime + phosphate + nitrogen + potash).

Treatment 7. Control - no fertiliser.

Applications of fertiliser are to be made at the following rates:—

Lime: One ton agricultural lime per acre.

Phosphate: 200 lbs. superphosphate per acre.

Nitrogen: 50 lbs. ammonium nitrate per acre.

Potash: 50 lbs. muriate of potash per acre.

Twenty-eight acres of fairly uniform vlei-land were ploughed and harrowed towards the end of the 1946-47 summer, and further discings were carried out in winter and early summer of 1947-48. The ground was then contour-ridged on the level, and fertiliser treatments were applied according to the above plan in December. Upright Paspalum seed was then sown at the rate of 10 lbs. per acre. It was anticipated that the ploughing and discing treatments would have been sufficient to eliminate or at least greatly reduce the invasion by indigenous weeds, but this has unfortunately not been the case, and although the Paspalum has germinated well, it will have to withstand severe competition from a variety of indigenous sedges and grasses. It appears that a smother crop, preferably of legume, may have to be sown in virgin vlei soil in the first year and later ploughed in to help control weed growth.

A second experiment on similar lines to the above, but on a much smaller scale, has also been commenced. Here, however, the effects of fertiliser will be studied without the influence of grazing.

The plots are only 20 x 25 yds., but each treatment is replicated three times. The seed was sown on the 6th and 7th February, 1947, and, in spite of the drought, germinated well. The young seedlings came through the long, dry winter with few casualties, and with the advent of the present season's rains put on a quick heavy growth, particularly in the plots treated with phosphates. This response to phosphate has been most marked in every plot, and was evident even in the initial stages when the seedlings were darker green in colour and showed a much more vigorous growth than those without phosphate. It also appeared that the percentage survival of the seedlings was higher in the phosphate-treated plots. This experiment is being carried out by the Pasture Research Chemist and is the subject of a separate report.

Effects of Minor Elements on Vlei Pastures.

Object. To investigate the effects of minor elements on a Paspalum dilatatum vlei pasture.

Design. 24 plots, each 5 yds. x 5 yds., are treated as follows:—

Treatment 1. NPKCa.

Treatment 2. NPKCa + 2 lbs. borax per acre.

Treatment 3. NPKCa + 25 lbs. copper sulphate per acre.

Treatment 4. NPKCa + 10 lbs. zinc sulphate per acre.

Treatment 5. NPKCa + 2 lbs. sodium molybdate per acre.

Treatment 6. NPKCa + 25 lbs. manganese sulphate per acre.

Treatment 7. NPKCa + 50 lbs. magnesium sulphate per acre.

Treatment 8. NPKCa + all the above (2-7).

Paspalum dilatatum was planted in December, 1946. The grass made little growth during the first season but is now well established, and certain differences between the various treatments are beginning to show up. The fertiliser and trace element treatments have been continued, and yield cuts were taken during the present season (April, 1948). Detailed results will be reported as soon as available.

4. **SOIL AND WATER CONSERVATION INVESTIGATIONS.** Under this heading studies are to be made of the comparative run-off and loss of soil with different types of vegetal cover and treatment, and rainfall percolation and soil moisture studies under different types of vegetation will be carried out as well. (For further details of these experiments, which have not yet been commenced, see later section of the report headed "Future Experimental Project.")

A necessary preliminary to certain of these experiments is the behaviour of the water table over a period of years in order to be able to arrive at some basic standard as a yardstick with which various treatments can be compared. For this purpose a series of 54 perforated iron pipes of 3 in. diameter have therefore been sunk in a vlei area at varying depths, depending on the underground formation, and the water table has been measured monthly since October, 1946.

Graph No. 3 shows the curves obtained from the measurements taken in four of these pipes during the period October, 1946, to December, 1947. The faint dotted line in each curve indicates the time during which the water-table had fallen below the depth to which the pipe was originally sunk, and was therefore not measurable.

The behaviour of the water-table near the surface, as shown in curve No. 20, was peculiar. There was a fall during the first 3 ins. of rain and then a rise after a second 3 ins. in December, but it dropped again immediately afterwards in spite of a further 9 ins. in January. From then on it followed the rainfall curve, rising with good rains in March and falling steadily until November, when it rose sharply with the arrival of the 1947-48 summer rains.

The water-table at depths between 2 ft. and 7 ft. continued to drop for the first two months after the rains had started, and thereafter followed the rainfall curve fairly closely.

From the general flattening of all the water table curves, it appears that the rate at which the water-table drops decreases as the season progresses, and is very slow by the time the next rainy season commences. The length of the lag period after the rains start, however, has so far been variable, and these measurements will have to be continued over a number of years (and a variety of rainy seasons) to determine this period with any accuracy.

GENERAL SECTION.

NURSERY WORK. A nursery has been established which includes the three main soil types associated with the sandveld, viz.:—

(a) Topland (typical thatching grass and Eriosema veld)

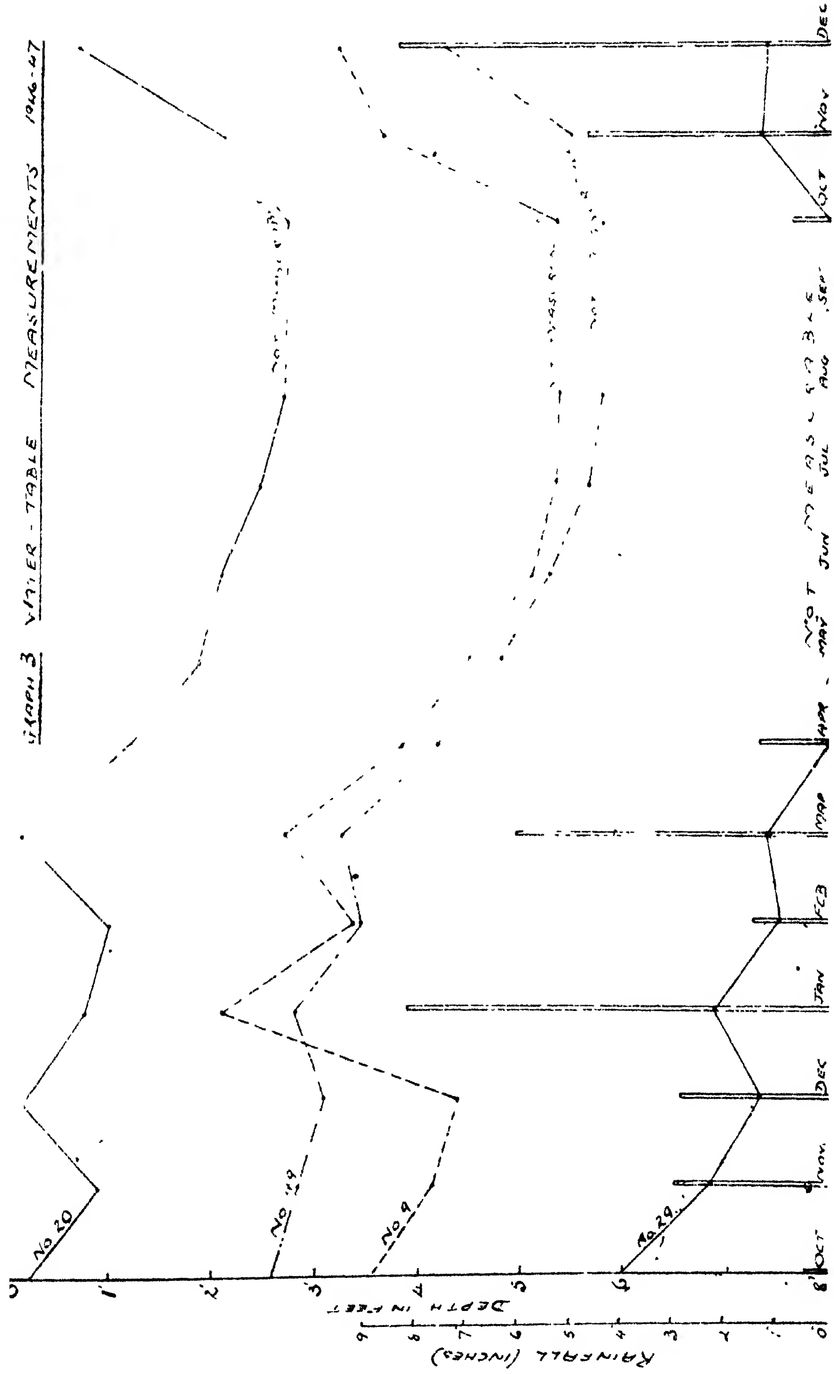
(b) Semi-vlei—the zone of low fertility between the topland and vlei proper.

(c) The typical vlei area which becomes temporarily waterlogged during normal rainy seasons.

In this nursery, trials of promising introduced and indigenous fodder and pasture plants are being made, and methods of propagation and seed production studied.

A large number of grasses have already been planted out in the nursery beds from roots, and the majority of these are well established. Many different grass species and legumes have also been sown from seed, particularly during the 1946-47 season, but the droughty conditions prevalent at that time resulted in very severe losses, and only a few plants have survived. Several types of pod-bearing trees have been grown from seed in pots (made from soil and compost), and have been planted out in a separate part of the station.

HERBARIUM. Plant collections have been made in different parts of the country, and the specimens have been mounted and filed. Nearly 1,000 sheets have so far been prepared.


GRAPH 3 WATER-TABLE MEASUREMENTS 1946-47
No 20
No 19
No 9
No 29.
OCT NOV. DEC JAN FEB MAR APR MAY JUN JUL AUG SEP. OCT NOV DEC
NOT MEASURABLE
DEPTH IN FEET
RAINFALL (INCHES)

Distribution of Grass Roots. Over 100 bags of grass roots have been distributed to farmers in different parts of the country, the chief varieties being Star grass (Nos. 2 and 4) *Acroceras macrum* and Waterfall Finger grass.

Publications. The following articles have been published in the "Rhodesia Agricultural Journal":—

"Report on Tour of Pasture Research Stations in the Union of South Africa," by J. M. Rattray, Vol. XLIII, No. 5, Sept.-Oct., 1946.

"Preliminary Results in Improving the Sandveld Vleis on the Grassland Experiment Station, Marandellas," by J. M. Rattray and R. H. Fitt, Vol. XLIV, No. 1, Jan.-Feb., 1947.

"Giant Rhodes Grass Pastures at Trelawney," by J. M. Rattray, Vol. XLIV, No. 4, July-Aug., 1947.

FUTURE EXPERIMENTAL PROJECTS.

Veld Utilisation Studies. Two veld utilisation experiments have been designed and the areas surveyed, and as soon as the stumping contractor becomes available to remove the necessary trees, the trials will be put into operation. These two experiments are described as follows:—

1. **Bush Clearing in Relation to Grazing and Browse Production.**

Object. To observe the effect of clearing trees and bush on the carrying capacity of Msasa-veld and to ascertain the relative value of the grazing and browse thus provided.

Design. There will be four 20-acre camps treated as follows:—

Treatment 1. Untouched tree-veld.

Treatment 2. Completely stumped (i.e., trees taken out with the roots), except for two or three shade trees per acre, and all bush removed.

Treatment 3. Cleared to parkland leaving browse (i.e., trees cut off at ground level to allow coppice growth).

Treatment 4. Cleared to parkland leaving no browse (i.e., trees taken out with roots and all shrubs and herbs removed as well).

2. **Tree Espacement in Pasture Production.**

Object. To determine the effect of clearing trees and bush from Msasa tree-veld on pasture production.

Design. Five 2½-acre plots are to be treated as follows:—

Treatment 1. Completely cleared of all trees.

Treatment 2. 6 trees per acre to be left.

Treatment 3. 12 trees per acre to be left.

Treatment 4. 18 trees per acre to be left.

Treatment 5. Control plot untouched.

Established Pastures. Under this heading further investigational work will be carried out with topland pastures of Star grass, particularly in relation to the effect of fertilisers, in order

to obtain some data on the economics of such treatments. Similar studies will be made with vlei-land pastures of Swamp couch and *Acroceras macrum*.

SOIL AND WATER CONSERVATION STUDIES.

Percolation. In order to determine the amount of percolation which takes place during the rains in topland grazing areas, lysimeters (instruments for collecting and measuring water which has percolated through the soil) will be placed 5 ft., 10 ft. and 15 ft. below the surface in ordinary Msasa tree-veld and in grassland from which the trees have been removed. In this way a study can be made of the amount of rain water which a good grass cover will hold back and allow to seep into the soil as compared with that held back by a sparse grass cover.

Run-off. The amount of run-off from topland soil under different types of vegetation will be measured in the following treatments:

Treatment 1. Natural grassland grazed and trimmed by mower when necessary.

Treatment 2. Natural grassland grazed, but burned if necessary after the first rains.

Treatment 3. Star grass grazed and trimmed by mower when necessary.

Treatment 4. Msasa veld, including trees, untouched.

Treatment 5. Msasa veld grazed.

Treatment 6. Msasa veld grazed and burned when necessary.

Treatment 7. Maize and compost first year, velvet beans in second year.

General Ecological Investigations. During the course of all the experimental work, notes and observations are made on the vegetation with a view to obtaining information on the grazing value of the various stages of succession, the importance of indicator plants in grazing management systems and the ecological classification of the various plant associations.

Rhodesian Milk Records.

OFFICIAL MILK RECORDS.

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner
Matopo Topsy	Red Poll	Mature	5894.80	243 15	4.12	220	Govt. Experimental Station, P.B. 19K, Bulawayo.
Matopo Una ...	Red Poll	Senior 3 year	5382.60	214 10	3.79	300	
Matopo Queenly	Red Poll	Mature	8432.80	306 37	3.63	300	
Matopo Umfazi	Red Poll	Senior 3 year	9799.40	302 18	3.08	280	
Matopo Ulinda	Red Poll	Junior 3 year	6761.20	275.20	4.07	300	
Fairseat Oxfordia's Barbette ..	Jersey.	2 years	4426.00	211 90	4 79	277	J. H Keightley, Moorfield, Glendale.
Meadow's Pioneer Wallflower	Jersey..	Junior 3 year	4776.50	291.00	6.09	267	
Albertvale Bokwagen XVI. Recalved 19/12/47	Friesland	Mature	8072 50	264 26	3.27	274	T. C Pascoe, Crowborough Estate, Box 1253, Salisbury.
Albertvale Andre XXXV. ... ... Recalved 6/1/48	Friesland	Mature	8735.50	271.49	3.11	300	

SEMI-OFFICIAL MILK RECORDS.

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner
Bromley	G Friesland	Mature	7227.90	232.91	3.22	287	D. A. Allan, Pendennis, P.O. Avondale.
Maisie	G. Friesland	Mature	7063.70	235.44	3.33	300	
Wamunda	G. Friesland	Mature	9308.80	302.75	3.25	300	
Zarimuso	G. Friesland ..	Mature	8164.50	302.01	3.70	300	
Chipolilo...	G. Friesland ..	Mature	6915.20	261.47	3.78	300	
Fanny... ..	G. Friesland ..	3 years	7294.90	234.42	3.20	300	Mrs. M. Allan, Pendennis, P.O. Avondale
Alice	G. Friesland	3 years	6851.40	231.44	3.38	300	
Sonia ..	G. Friesland ..	3 years	7091.30	270.64	3.80	300	
Transvaal	G. Friesland	Mature	9554.00	362.15	3.79	300	R. A. Ballantyne, Box 801. Salisbury.
Chimsoro	G. Friesland	Mature	5812 00	246.23	4.24	242	
Canada	G. Friesland	4 years	6263.00	231.67	3.70	300	

Mother	G. Friesland	Mature	5709.40	235.18	4 12	217	J. A. Baxter, Glen Norah, Box 1368, Salisbury.
Flower	G. Friesland	Mature	5543 40	228.72	4 11	252	
Clacupar Peacebrand	P.B. Friesland	4 years	5807 40	249 30	4.29	300	
Susan	G. Friesland	Mature	6092.80	369.08	6 58	300	
Clacupar Panica Pen	P.B. Friesland	Mature	9426.30	343 09	3.64	300	
Japan	G. Friesland	Mature	8860.90	274 67	3.10	300	
Kharkov	G. Friesland	Mature	7031.10	243.02	3 46	300	
Crisman	G. Friesland	Mature	5998 60	228.12	3.80	300	
Addis Ababa	G. Friesland	Mature	6680 70	234 25	3.51	300	
Sidney	G. Friesland	Mature	7162.40	246.97	3 45	300	
Store	G. Friesland	Mature	6266.10	240.08	3 83	300	
Doreen	G. Friesland	Mature	5491 00	231 95	4.22	300	N. G. Barrett, Gaveny, Rusapi
Inez	G. Friesland	Mature	5817 40	250.85	4 31	300	
D. 61	G. Friesland	Mature	7724 30	299 39	3 88	222	A. L. Bickle, Box 595, Bulawayo
D. 26	G. Friesland	Mature	7521 80	263.81	3.51	300	
D. 59	G. Friesland	Mature	8838 50	311 47	3 52	300	
D. 24	G. Friesland	Mature	7008.60	272 08	3.89	300	
Do. 102	G. Friesland	Mature	9918.20	371 18	3.74	266	
D. 45	G. Friesland	Mature	10541.00	398 65	3 69	300	
D. 58	G. Friesland	Mature	10042 90	364 67	3 63	300	
D. 103	G. Friesland	Mature	11352 70	404 73	3 57	300	
D. 52	G. Friesland	Mature	7882 00	287 19	3 64	289	
D. 48	G. Friesland	Mature	11745 70	419 91	3 58	300	
D. 23	G. Friesland	Mature	11147.60	343 40	3 08	300	
D. 2	G. Friesland	Mature	12467 70	477.76	3 83	300	
Helenvale Jessie	P.B. Friesland	2 years	6472.80	252.53	3 90	269	
Helenvale Juliette	P.B. Friesland	3 years	7882 10	267.31	3 39	300	
No. 72	P.B. Friesland	Mature	10594.90	351.94	3 32	284	
No. 71	G. Friesland	Mature	8957 70	307 61	3.43	234	
D. 36	G. Friesland	Mature	9249 00	331 95	3 59	270	
D. 124	G. Friesland	4 years	8435 80	309 48	3 67	262	
D. 116	G. Friesland	4 years	7753 10	254 39	3 28	262	
D. 105	G. Friesland	Mature	9302 30	372.17	4.00	281	
D. 121	G. Friesland	4 years	7431 20	287 60	3 88	268	
D. 44	G. Friesland	Mature	11622.40	359 37	3.09	300	
D. 27	G. Friesland	Mature	7096 40	281.24	3 96	286	
D. 49	G. Friesland	Mature	10512.10	374 81	3 57	284	
Jutice III	G. Friesland	2 years	5786 90	235 75	4 07	300	Mrs. M. Black, Burnside, P.O. Bindura
Judy II	G. Friesland	4 years	7700 50	319 14	4 14	300	

SEMI-OFFICIAL.—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B Fat in lbs.	Average % B. Fat	No. of Days.	Name and Address of Owner.
No. 98	G. Friesland	Mature	7829.00	308.51	3.94	300	C. Boyd Clark, Mount Zonga, Inyazura.
Dirko Jessie	P.B. Friesland	Mature	9159.00	351.08	3.83	290	
Dirko Swart Kapel	P.B. Friesland	Mature	7017.00	251.39	3.58	300	
Truant III.	G. Friesland	Mature	8810.00	334.78	3.80	242	
No. 245	G. Friesland	4 years	6397.00	237.75	3.72	257	
Flower	G. Friesland	Mature	7180.00	234.96	3.27	300	B.S.A. Co., Mazoe Citrus Estate, P.O. Mazoe.
White II	G. Friesland	4 years	10680.50	327.48	3.07	300	
Cicely	G. Friesland	4 years	7679.00	298.44	3.89	300	E. Butler, Woodlands, P.O. Shamva
Emily	G. Friesland	4 years	7704.00	314.46	4.08	300	
Emily	G. Friesland	Mature	8039.00	265.69	3.30	300	L. E. O. Cary, Clovelly, P.O. Trelawney.
Oubliette	G. Friesland	4 years	11090.10	408.48	3.68	300	T. Cousins, Oaklands, P/Bag 20, Gwelo
Singara	G. Friesland	Mature	6700.00	227.50	3.40	300	J. Cumming, Hillside, Norton
Blake	G. Friesland	Mature	7895.00	284.20	3.60	272	
Anna	G. Friesland	Mature	7292.60	277.08	3.80	255	Daisyfield Orphanage, P/Bag 151 Q, Bulawayo.
Porky III	G. Friesland	Mature	7826.00	299.23	3.84	300	A. C. de Olano, Blue Waters, Bromley.
Betty	G. Friesland	4 years	7996.00	288.33	3.61	300	
Porky II	G. Friesland	Mature	6985.00	267.39	3.83	300	
Pillow I.	G. Friesland	Mature	8107.00	271.07	3.34	300	
Lea	G. Friesland	Mature	6898.00	305.71	4.43	300	
Mafuta	G. Friesland	Mature	6846.60	283.70	4.14	300	A. B. Dobson, Endeavour Farm, Norton
Blantyre	G. Friesland	Mature	6434.50	225.84	3.51	300	
Marita	G. Friesland	Mature	6947.20	240.16	3.46	300	
Newlands	G. Friesland	4 years	6097.90	241.30	3.96	300	
No. 113.	G. Friesland	Mature	6286.70	242.71	3.86	283	J. B. Dold, Box 1153, Salisbury.
No. A 99	G. Friesland	4 years	7622.10	278.06	3.65	300	
No. 356	G. Guernsey	Mature	8330.80	355.94	4.27	300	B. St. J. D. Downs, Safago, P.B. Gwelo
No. 369	G. Guernsey	Mature	6269.00	242.58	3.87	248	
No. 406	G. Guernsey	Mature	6668.10	239.07	3.57	300	
No. 424	G. Guernsey	4 years	6066.20	263.59	4.35	266	

No. 206	G. Friesland	Mature	6693.00	253.09	3.78	247	Mrs. M. Everard, Castle Zonga, Inyazura.
Zonga Queen III.	P.B. Friesland	Mature	5345.00	226.09	4.25	300	
No. 235	G. Friesland	Mature	9209.00	335.50	3.64	300	H. C. Fischer, Olivia Farm, Headlands
No. 76	G. Friesland	3 years	7369.00	277.13	3.76	258	
No. 208	G. Friesland	Mature	7258.50	283.66	3.91	300	
No. 140	G. Friesland	3 years	9055.00	312.55	3.45	300	R. le S. Fischer, Wakefield, Headlands
No. 74	G. Friesland	4 years	10182.00	332.12	3.26	300	
No. 112	G. Friesland	3 years	9056.00	329.58	3.64	300	
No. 118	G. Friesland	Mature	10129.00	357.24	3.53	261	
No. 62	G. Friesland	4 years	9606.00	297.66	3.09	300	
No. 46	G. Friesland	Mature	8368.00	274.40	3.28	300	
No. 202	G. Friesland	Mature	10068.00	330.81	3.29	300	
No. 100	G. Friesland	3 years	8074.00	355.96	4.41	300	
No. 193	G. Friesland	Mature	9824.00	368.82	3.75	300	
No. 206	G. Friesland	2 years	6221.00	234.83	3.77	300	
No. 207	G. Friesland	2 years	6744.00	248.08	3.68	300	
No. 214	G. Friesland	2 years	8113.00	269.91	3.33	300	
No. 212	G. Friesland	2 years	6790.00	235.58	3.47	300	
No. 213	G. Friesland	2 years	7706.00	252.50	3.28	296	
No. 38	G. Friesland	Mature	7871.00	286.10	3.65	271	
No. 160	G. Friesland	Mature	5911.00	235.39	3.98	252	
No. 31	G. Friesland	Mature	8486.00	303.22	3.58	300	
No. 72	G. Friesland	4 years	10942.00	417.01	3.81	300	
No. 82	G. Friesland	4 years	11299.00	377.09	3.43	300	
No. 132	G. Friesland	Mature	7286.00	242.78	3.33	300	
No. 153	G. Friesland	3 years	6531.00	229.59	3.53	300	
No. 51	G. Friesland	Mature	11038.00	403.67	3.66	300	
No. 116	G. Friesland	3 years	8679.00	317.85	3.66	300	
Marion	G. Friesland	Mature	6714.50	270.95	4.04	300	W. F. Fischer, Coldstream Dairy, Headlands.
12 A	G. Friesland	Mature	6555.00	250.97	3.77	248	
No. 421	G. Friesland	Mature	7426.00	253.61	3.42	300	
No. 347	G. Friesland	Mature	8091.00	305.68	3.78	300	
No. 467	G. Friesland	Mature	7529.00	275.20	3.66	300	
No. 531	G. Friesland	4 years	6728.50	297.22	4.42	300	
No. 326	G. Friesland	Mature	7039.50	250.91	3.56	285	
No. 343	G. Friesland	Mature	6940.50	234.43	3.38	300	
No. 434	G. Friesland	Mature	6431.50	238.30	3.71	300	
No. 302	G. Friesland	Mature	6563.00	253.66	3.87	300	
No. 548	G. Friesland	3 years	6247.00	234.32	3.75	300	
No. 405	G. Friesland	Mature	6458.50	270.75	4.19	300	
No. 499	G. Friesland	4 years	7311.50	300.73	4.11	237	

SEMI-OFFICIAL—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
Thipiri II ...	G. Friesland	Mature	9997.10	439.23	4.39	300	G. J. Franklin & Sons. Box 105, Umtali.
Penhalonga II.	G. Shorthorn	Mature	6024.50	263.11	4.37	207	
Makoni I. ...	G. Shorthorn	Mature	8339.80	375.13	4.49	275	
Very Nice II	G. Friesland	Mature	6563.70	254.32	3.74	215	
Ginger Beer	G. Friesland	20 months	9323.70	367.58	3.94	300	
Shandy ..	G. Friesland	Mature	5984.90	242.65	4.05	300	
Maude...	G. Friesland	2 years	8259.30	341.23	4.13	300	
Bubbles	G. Friesland	Mature	7551.80	264.06	3.50	263	
David	G. Friesland	Mature	8169.60	315.51	3.86	300	
Fairy	G. Friesland	Mature	7051.00	278.37	3.95	300	Hon H. V. Gibbs, Bonisa, Redbank, P.B. 52 L, Bulawayo.
Evelyn..	G. Friesland	Mature	7610.00	241.85	3.18	300	
Lily	G. Friesland	4 years	8154.00	274.10	3.36	300	
Merle	G. Friesland	Mature	8672.00	268.21	3.09	300	
Watson	G. Friesland	Mature	9290.00	291.68	3.14	300	
Greta	G. Friesland	Mature	8300.00	263.37	3.17	300	
Nancy	G. Friesland	Mature	8681.00	274.71	3.16	300	
Connie	G. Friesland	4 years	6825.00	249.51	3.66	300	
Sonia	G. Friesland	Mature	7554.00	240.46	3.18	300	
Maggie	G. Friesland	Mature	7384.00	250.95	3.40	258	
Elizabeth ..	G. Friesland	Mature	5306.30	227.46	4.29	300	C. A. G. Gourlay, Dice Box, P.O. Box 244, Umtali.
Mafumira ..	G. Friesland	4 years	9052.70	284.77	3.54	300	Govt. Demonstration Farm, Umshandige, Fort Victoria.
Gwanda	G. Friesland	4 years	8771.90	308.89	3.52	295	
No. 140 ...	G. Red Poll	Mature	10610.70	395.07	3.72	300	Govt. Experiment Station, P.B 19 K., Bulawayo.
No. 185 ..	G. Red Poll	4 years	5604.50	248.19	4.43	300	
No. 107 ..	G. Red Poll	Mature	9404.00	389.57	4.14	300	
No. 197	G. Red Poll	3 years	10224.80	344.18	3.37	300	
Corvill...	G. Friesland	Mature	5231.00	225.60	4.31	209	Govt Farm Gwebi, P.B. 76 B., Salisbury.
Fulmore (No. 15)	G. Friesland	Mature	8254.00	266.84	3.23	300	
Mustang (No. 7) ..	G. Friesland	Mature	7591.00	230.17	3.03	274	
Firefly (No. 14) ..	G. Friesland	Mature	8546.00	321.88	3.77	285	
Elfin D 193.. ..	G. Friesland	2 years	6294.80	269.27	4.27	272	E. E. C. Green, Box 879, Bulawayo.
No. E 207	G. Friesland	Mature	7615.70	288.30	3.79	277	
Garbo	G. Friesland	Mature	5575.70	225.00	4.04	276	

Laurie	G. Friesland	3 years	9220.00	309.04	3.35	286	R. J. Green, Box 443, Bulawayo.
Margot	G. Friesland	Mature	6400.00	228.93	3.58	262	
No. 7	G. Friesland	Mature	12662.30	504.34	3.98	300	Grasslands Experimental Station, Marandellas
No. 42	G. Friesland	4 years	13617.00	448.85	3.22	300	
No. 23	G. Friesland	Mature	12591.70	502.47	3.99	300	
No. 25	G. Friesland	Mature	10836.20	407.95	3.77	300	
No. 56	G. Friesland	3 years	7697.90	314.87	4.09	300	
Cherry	G. Guernsey	Mature	7358.40	310.54	4.22	300	D. A. Harley, Harleyton, Beatrice
Rosebud	G. Guernsey	Mature	5173.10	236.93	4.58	300	
Una	G. Guernsey	Mature	6072.10	239.68	3.95	300	
Lorna	G. Guernsey	Mature	6392.90	242.99	3.80	300	
Vida	G. Guernsey	Mature	6463.20	273.72	4.24	275	
Marion	G. Guernsey	Mature	5476.00	243.04	4.44	300	
Bessie	G. Guernsey	Mature	6335.00	253.83	4.01	300	Mrs. C. Harrison, Box 58, Shamva
Noisette	G. Guernsey	Mature	6412.70	314.03	4.90	282	Mrs. L. M. H. Howard, Nengwa Farm, Beatrice
Jennifer	G. Guernsey	3 years	5000.90	241.59	4.83	300	
Lady of Satago	P.B. Guernsey	2 years	5006.00	234.48	4.68	300	T. C. L. Howard, Nengwa Farm, Beatrice
Lucky	G. Friesland	3 years	7242.80	246.07	3.40	251	D. J. Huddy, Box 718, Salisbury.
Emily	G. Friesland	Mature	6949.70	229.38	3.30	253	L. Huddy, Box 924, Salisbury
Stingo	G. Friesland	Mature	6245.20	262.50	4.20	295	
Como	G. Friesland	Mature	6766.10	242.12	3.58	300	
Gundaan	G. Friesland	Mature	7688.50	279.60	3.64	275	
Xmas	G. Friesland	3 years	6563.40	233.58	3.55	300	
Beatrice	G. Guernsey	Mature	5750.00	245.23	4.26	300	Mrs. M. R. Huddy, Box 899, Salisbury.
Norah	G. Friesland	Mature	6053.10	234.46	3.87	300	I. Jaffe, Mazani, c/o Barclays Bank, Umtali.
No. 20	G. Friesland	Mature	8711.00	284.24	3.26	300	D. S. Kabot, Box 261, Bulawayo
No. 59	G. Friesland	Mature	8434.00	281.44	3.34	300	
No. 84	G. Friesland	3 years	12702.00	486.00	3.83	300	
No. 5	G. Friesland	Mature	8129.00	298.56	3.67	300	
No. 22	G. Friesland	4 years	9121.00	410.17	4.50	300	
No. 10	G. Friesland	Mature	9515.00	307.30	3.23	300	
No. 4	G. Friesland	Mature	9758.00	316.21	3.24	300	
No. 77	G. Friesland	4 years	8654.00	407.32	4.71	300	
D. 15	G. Friesland	Mature	6735.90	316.03	4.69	251	B. H. Kew, Box 972, Bulawayo
K. 14	G. Friesland	Mature	8429.10	291.27	3.49	300	

SEMI-OFFICIAL—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs	B. Fat in lbs	Average % B. Fat	No. of Days.	Name and Address of Owner
Dora ..	G. Friesland	Mature	6087.50	246.18	4 04	300	D. King, Rockwood Farm, Concession.
Axel ..	G. Friesland	Mature	5280.00	254.59	4.82	300	
Kingston Nurse	G. Friesland	Mature	7505 00	293.24	3 91	300	Kingston Farm Syn., Bo— 2, Bindura.
Pennance II ..	G Friesland	4 years	7793 70	295.57	3 79	300	H. Knill, Mendamu, Marandellas.
Maureen...	G. Jersey	Mature	4988.10	260.27	5 21	285	E. M. Kok, Everton, Inyazura.
Violet	G. Jersey.	2 years	3849 40	241.21	6.27	287	
Jane ..	G Friesland	Mature	6906.10	225 18	3 26	300	Mrs. M. M Krahner, Haydock Park, Banket
Goldie..	G Friesland	Mature	6565.50	255 28	3.85	300	
Mary ...	G. Friesland	Mature	7845.00	255 73	3 26	300	
Caroline	G. Ayrshire	Mature	5619.60	245.32	4 36	300	
No. 6 ..	G. Friesland	Mature	7905.10	307.74	3 89	290	H T Lay, P B 107 C., Salisbury.
No. 27	G. Friesland	3 years	6671 70	264.80	3.97	300	
No. 11.	G. Friesland	Mature	7353.80	250 92	3.41	300	
Mattress ...	G. Friesland	Mature	8761.80	328.85	3 75	300	P Linton, Box 898, Salisbury.
Gundwaan III ...	G Friesland	Mature	9285 90	402.76	4 34	290	
Meck II.	G. Friesland	Mature	6109.10	259.72	4.25	300	
Butterfly...	G. Friesland	Mature	9143.40	297 42	3 25	300	
Gundwani I. ..	G. Hereford	Mature	6011 30	279.96	4.66	300	
Bromley ..	G. Friesland	Mature	6902.80	295 42	4 28	300	
Beans I.	G. Friesland	Mature	8536 00	296.77	3.48	300	
Lawyer III..	G. Friesland	Mature	10212.10	392 49	3 84	300	
Shapiro II.	G. Friesland	Mature	7511 00	265.06	3 53	300	
Ardbennie II	G. Friesland	Mature	6429.40	266 95	4 15	300	
Coat ..	G. Friesland	Mature	8924 40	329 19	3 69	300	
No. 9	G. Friesland	Mature	7475 50	249 05	3 33	300	D. W. Marshall, Alderberry, Box 164, Umtali.
Black ..	G. Aber. Angus	Mature	7168.60	321 41	4 48	300	Liet.-Col. C. I. F. Maynard, Melfort, P B 112C., Salisbury.
Hattie.	G. Jersey	3 years	5979 50	270.83	4 53	300	
Jane ...	G. Jersey.	3 years	7343 70	264 02	3 60	300	

No. 23 ...	G Red Poll	Mature	6542.80	254 36	3 89	280	L McLean, Box 161, Gwelo.
No. 40..	G. Friesland	2 years	8149 20	257.52	3 16	300	
No. 42	G. Friesland	2 years	6832 70	241.98	3 54	300	
No. 44...	G. Friesland	2 years	6138 20	238.56	3 89	300	
No. 53.	G. Friesland	3 years	7105 80	237.95	3 35	300	
P. 9/8	P.B. Friesland	Mature	8475 00	270 16	3 19	300	Thos Meikles Trust & Invest. Co, Ltd, Leachdale Farm, Shangani
P. 5/3	P.B. Friesland	3 years	6263 00	239 90	3 82	300	
P. 12/3	P.B. Friesland	4 years	6750 00	240 25	3 56	300	
P. 14/3.	P.B. Friesland	4 years	6276 00	228 52	3 64	300	
P. 25/3.	P.B. Friesland	3 years	6582 00	225 05	3 42	300	
P. 27/3.	P.B. Friesland	3 years	8777 00	268 03	3 05	300	
15/7	P.B. Friesland	Mature	8858 00	302 71	3 42	300	
4/9...	P.B. Friesland	Mature	9507.00	302 02	3 18	300	
G. 20/0	G. Friesland	Mature	6593 00	281 97	3 28	300	
G. 3/3	G. Friesland	4 years	6677.00	259 07	3 88	300	
G 11/3	G. Friesland	3 years	7271 00	261 21	3.46	300	
G. 16/3	G. Friesland	3 years	7840 00	273 27	3 49	300	
G. 26/3	G. Friesland	3 years	8592 00	313 99	3 65	300	
G. 30/3	G. Friesland	3 years	8131 00	333 93	4 11	300	
G. 37/3	G. Friesland	3 years	7162 00	243 88	3 41	300	
G. 15/7	G. Friesland	Mature	10117 00	320 33	3 17	300	
G. 32/7	G. Friesland	Mature	10812 00	342 36	3.17	300	
G 6/8.	G. Friesland	Mature	9765 00	311 54	3 19	300	
3/9	G. Friesland	Mature	7531 00	255 97	3.40	300	
16/9	G. Friesland	Mature	8272 00	269 25	3 25	300	
G. 22/9	G. Friesland	Mature	8976 00	325.12	3 62	300	
No. 132.	G. Friesland	Mature	12524 00	338.14	3 10	300	
Birdie II	G. Friesland	Mature	7058 50	268 68	3 81	300	S Moore, Nyatsime, Box 999, Salisbury
G. I.	G. Guernsey	Mature	6373 80	254 07	3 99	300	
Manjasi	G. Friesland	Mature	4737.00	227 62	4 81	300	Comdr. E L Morant, Box 741, Salisbury
Penelope	G. Ayrshire	Mature	7462 60	271 52	3 64	300	
No 4	G. Friesland	Mature	6629 00	254 80	3 69	300	
Norah	G. Ayrshire	Mature	6966 50	287.25	4.13	300	
Octavia	G. Ayrshire	Mature	6256 30	251 34	4 02	300	
Maisie	G. Ayrshire	Mature	8318.00	305 12	3 67	300	
Molly	G. Ayrshire	Mature	6667 50	275 43	4 13	300	
Nightingale	G. Ayrshire	Mature	7972.90	299 79	3.76	300	
Victoria	G. Friesland	Mature	7192 00	260 75	3 63	273	K. Norvall, Box 637, Bulawayo.
Fly ...	G. Friesland	Mature	7860 00	247.83	3.15	268	
Cherry I.	G. Friesland	4 years	7092.00	292 16	4 12	300	
Mziki.	G. Friesland	4 years	6607 00	246.54	3 73	276	

SEMI-OFFICIAL—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
Katang	G. Red Poll	Mature	6811.00	270.79	3.98	300	K. Norvall, P.O. Box 637, Bulawayo.
Girlie	G. Friesland	Mature	8082.00	285.43	3.53	300	
Zenda	G. Friesland	Mature	7413.00	301.83	4.07	300	
Countess of Cartiep	P.B. Friesland	Mature	11421.00	399.97	3.50	300	
T.J.	G. Friesland	Mature	7991.00	240.69	3.01	300	
Queenie	G. Friesland	4 years	6699.00	227.95	3.40	300	
Exwell Emma	P.B. Friesland	4 years	7115.00	236.57	3.32	300	
Exwell Aaltje	P.B. Friesland	3 years	6459.00	237.81	3.68	300	
Vlakmeis	G. Friesland	Mature	15748.50	567.46	3.60	300	Mrs. M. Parsons, Box 7, Bulawayo.
Torch	G. Friesland	Mature	10939.00	410.61	3.75	300	
Stumps	G. Friesland	Mature	8491.50	308.84	3.64	300	
Rose	G. Friesland	Mature	11986.00	386.86	3.23	300	
Hilda	G. Friesland	Mature	14168.00	503.21	3.55	300	
No. 62	G. Jersey	Mature	6585.50	283.31	4.32	300	T. C. Pascoe, Crowborough, Box 1253, Salisbury.
No. 198	G. Friesland	4 years	6942.00	315.88	4.55	292	
No. 187	G. Friesland	Mature	6302.00	237.17	3.76	300	
No. 54	G. Friesland	Mature	7205.00	284.24	3.95	300	J. Picken, Iron Mine Hill Farm, Iron Mine Hill.
Rice	G. Friesland	Mature	8420.80	264.04	3.14	300	Mrs. M. Rogers, Bickford, P.O. Gwelo.
Maswina	G. Friesland	3 years	6682.20	300.78	4.49	300	W. F. H. Scutt, Maple Leaf, Norton.
Agnes	G. Red Poll	Mature	5571.70	226.35	4.06	300	K. M. Simpson, Box 96, Salisbury.
Sophie	G. Red Poll	Mature	6687.80	230.18	3.44	300	
Chekamunda	G. Friesland	Mature	5808.00	239.48	4.10	300	E. Stanger, Chimbi Source, Rusapi.
Eggins	G. Friesland	Mature	6601.00	239.61	3.63	264	Susman & Newfield, Box 959, Salisbury
December	G. Friesland	Mature	8174.00	306.48	3.75	287	Evelyn Tanson Trust Ltd., Lesape Falls, Rusapi.
Goley	G. Friesland	Mature	6418.00	237.80	3.71	281	
Djonifa I.	G. Friesland	Mature	6542.00	238.71	3.65	300	
Capetown	G. Friesland	Mature	7698.00	275.82	3.58	289	
Night	G. Friesland	Mature	6409.00	244.88	3.82	289	
Rirwey	G. Ayrshire	Mature	7965.00	321.64	4.04	300	

Rosie	G. Friesland	3 years	5508.10	252.39	4.58	300	Est. late Mrs. J. G. Taylor, Box 55, Selukwe
Tiger	G. Friesland	Mature	5319.50	243.34	4.57	297	
Cousins (1)	G. Friesland	Mature	6810.50	253.89	3.73	300	
Cousins (2)	G. Friesland	Mature	10250.40	343.48	3.34	300	
Nema	G. Friesland	3 years	5405.50	234.58	4.34	300	
Johnnie	G. Friesland	Mature	8631.50	272.08	3.13	300	
Blackie	G. Friesland	3 years	5595.60	236.56	4.38	300	
Shabani	G. Friesland	3 years	5701.50	255.23	4.48	300	
Zurum	G. Friesland	Mature	7990.60	268.25	3.36	292	
Bantu	G. Friesland	3 years	5234.00	257.21	4.91	300	
Hamba Lala	G. Friesland	Mature	7014.70	246.25	3.51	300	
Una	G. Friesland	Mature	6369.10	227.75	3.57	300	A. W. Tennent, Kelvin, Headlands.
Helen	G. Friesland	Mature	6175.30	249.86	4.05	300	
Jerry	G. Friesland	Mature	6060.20	226.08	3.73	300	
Lady	G. Friesland	Mature	6104.70	251.23	4.12	300	
Gladys	G. Friesland	Mature	8170.00	284.20	3.48	300	
Heather	G. Friesland	Mature	7240.70	251.13	3.47	300	
Nellie	G. Friesland	Mature	6911.10	257.81	3.73	300	
Daisy	G. Friesland	3 years	5546.80	249.54	4.50	300	
Bloom II.	G. Red Poll	4 years	5570.30	229.69	4.12	269	J. G. Thurlow, Atherstone, Bindura
Nancy VI	G. Friesland	Mature	5941.00	256.80	4.32	300	P. S. Timms, Chitora, Rusapi
Nancy VII	G. Friesland	Mature	6241.00	239.69	3.84	300	
No. 114	G. Red Poll	Mature	6364.50	230.60	3.62	300	A. M. Tredgold, P.B. 61 L., Bulawayo.
Nellie	G. Friesland	4 years	11677.60	367.65	3.15	300	Mrs. M. Turnbull, Box 479, Bulawayo.
Blackie	G. Friesland	Mature	9278.60	335.98	3.62	300	
Valerie	G. Friesland	Mature	9200.00	318.03	3.46	300	Miss I. van Niekerk, Claremont Farm, Inyanga

Southern Rhodesia Veterinary Report

FEBRUARY, 1948.

General. Cattle are in good condition although the lack of rain affecting crops and grazing caused concern in many districts.

Tick Life. Is reported to be active in all districts with the exception of districts where drought conditions have prevailed.

Diseases. African Coast Fever.

Salisbury District: No cases occurred on the farm Highlands.

Melsetter and Chipinga Districts: No cases on any of the infected farms.

Anthrax: A suspected case in the Belingwe Reserve has been reported and all cattle in this area inoculated.

Trypanosomiasis: In Chipinga district, on the Eastern Border, twelve further cases were recorded.

Lumpy Skin Disease: No cases reported.

Quarter Evil: An outbreak occurred among calves in the Melsetter district resulting in twelve deaths.

Epi-Vaginitis: Infection was diagnosed in three bulls.

Theileriosis: No cases reported.

Heart Water: No cases reported.

Anaplasmosis: Reported from all districts, except Umtali, with a mortality of 66 head.

Piroplasmosis: Reported in the Salisbury district with a mortality of 20 head.

Foot and Mouth Disease:

Chipinga-Melsetter Districts: No extension of the disease occurred in these areas.

Buhera Native District: In the infected area in the southern part of the Sabi Reserve, Buhera district, all cattle were inoculated and cattle free belts created. No further infection developed.

Fort Victoria Veterinary District: The disease was discovered in Bikita Reserve, at Mutsinzwa dipping tank area. This area, along with the two in contact dipping tank areas, was inoculated after cattle free belts with cordons had been established and no further extensions have occurred.

Mallein Testing. 32 horses and 8 mules were tested with negative results.

Tuberculin Testing. 35 bulls and 41 heifers were tested with negative results.

IMPORTATIONS.

Union of South Africa. Cows and calves (breding) 23, horses and mares 19, bulls (breeding) 35, geldings 18, mules 8, sheep (slaughter) 101.

Bechuanaland Protectorate: Cows and calves (breeding) 18, oxen (slaughter) 319, cows and calves (slaughter) 133, bulls (slaughter) 34, geldings 2.

EXPORTATIONS.

Belgian Congo: Bulls (breeding) 32.

Northern Rhodesia: Bulls (breeding 10, pigs (breeding) 5.

Portuguese East Africa: Oxen (slaughter) 26, cows (slaughter) 20.

EXPORTATIONS—MISCELLANEOUS.

In Cold Storage.

United Kingdom: Bacon 117,967 lbs., offal 12,300 lbs

Belgian Congo: Beef 79,840 lbs., offal 4,167 lbs.

Bechuanaland Protectorate: Beef 1,302 lbs., bacon 6 lbs., sausage 11 lbs., offal 180 lbs., dripping 161 lbs

Meat Products from Liebeg's (Rhodesia) Ltd., West Nicholson.

Nil.

J. E. ADAMSON,
For Chief Veterinary Surgeon.

MARCH, 1948.

General. Heavy rains occurred throughout the Colony, in some districts affecting the condition of cattle.

Tick Life. Is reported to be very active

Diseases. African Coast Fever.

Salisbury District: Two deaths occurred on the farm High lands.

Melsetter and Chipinga Districts: No cases on any of the infected farms.

Anthrax: No cases reported.

Trypanosomiasis: In Chipinga district 16 further cases were reported.

Lumpy Skin Disease: A few mild cases are reported in the Salisbury and Gwelo districts.

Quarter Evil: Cases are reported from the Salisbury and Melsetter districts.

Epi-Vaginitis: Infection was diagnosed in two bulls.

Theileriosis: Thirteen deaths occurred in the Marandellas district.

Heart Water: No cases reported.

Anaplasmosis: Numerous cases reported in the Salisbury, Bulawayo and Melsetter districts.

Piroplasmosis: Twenty-six cases were confirmed in the Salisbury district and three in the Bulawayo district.

Stiff Sickness: Stiff sickness is reported to be very prevalent in all districts with the exception of Umtali. The infection is stated to be serious in the Nyamandhlovu district and in the Salisbury district where deaths have occurred.

Foot and Mouth Disease.

Fort Victoria Veterinary District: No extensions occurred in the Bikita and Buhera areas.

Chipinga-Melsetter District: No extension of the disease occurred. The fenced corridor from the Sabi escarpment to the Portuguese Border was completed and the military cordon withdrawn and replaced by a native police cordon.

Umtali Veterinary District: The disease spread to this district, being found in Maranka Reserve on 17th March, 1948. The cattle in the southern portion of the Reserve were concentrated and inoculated. A cattle free cordoned belt was erected through the middle of the Reserve and the cordons linked up with those existing in Buhera and Chipinga areas.

Mallein Testing. 78 horses and 50 mules were tested with negative results.

Tuberculin Testing. 13 bulls, 7 cows and 135 heifers were tested, one heifer reacted.

IMPORTATIONS.

United Kingdom: Cows and calves (breeding) 4, bulls (breeding) 1.

Union of South Africa: Sheep (breeding) 70, cows and calves (breeding) 157, bulls (breeding) 10, horses, mares and geldings 76, mules 55.

Bechuanaland Protectorate: Oxen (slaughter) 131, cows (slaughter) 65, bulls (slaughter) 21, geldings 2.

EXPORTATIONS.

Portuguese East Africa: Oxen (slaughter) 64, cows (slaughter) 2, pigs (breeding) 1.

Belgian Congo. Pigs (breeding) 4, donkeys 64.

Northern Rhodesia: Pigs (breeding) 1, mules 41.

EXPORTATIONS—MISCELLANEOUS.

In Cold Storage.

United Kingdom: Bacon 256 lbs.

Belgian Congo: Goat meat 1,324 lbs., offal 9,193 lbs., beef 237,278 lbs., veal 1,916 lbs., Neats foot oil 1,746 lbs.

Bechuanaland Protectorate: Offal 113 lbs., beef 16 lbs., sausage 7 lbs., dripping 6 lbs., bacon 6 lbs.

Meat Products from Liebeg's (Rhodesia) Ltd., West Nicholson.

Nil.

J. E. ADAMSON,
For Chief Veterinary Surgeon.

SOUTHERN RHODESIA

Locust Invasion, 1932-48.

MONTHLY REPORT No. 186: APRIL, 1948.

Red Locust: *Nomadacris septemfasciata* Serv.

No Red Locusts in any stage of development within the Colony were reported.

J. WHELLAN,
Acting Chief Entomologist.

MONTHLY REPORT No. 187: MAY, 1948.

Red Locust: *Nomadacris septemfasciata* Serv.

No Red Locusts in any stage of development within the Colony were reported.

J. WHELLAN,
Acting Chief Entomologist.

THE RHODESIA
Agricultural Journal

Vol. XLV. No. 4 July-August, 1948.

Editorial

Notes and Comments

The report of the Chief Botanist and Plant Pathologist appears in this issue and the time seems opportune to make some general observations on Plant Disease.

MAIZE COB ROT.

During the past season a great deal of Cob Rot of Maize has been present in crops all over the Colony. This is probably partly due to the late and heavy rains making ideal conditions for infection. It is therefore essential that farmers should select their seed for the coming season with great care, as pointed out by the Chief Plant Pathologist in Mycological Notes in the March-April Journal. All *cobs* which have grains discoloured a dark pink or pale brown or have white streaks under the skin must be rejected. All these signs indicate that the cob is infected either with *Diplodia* or other fungi, and that the grains on it either will not germinate or will give a poor stand. A pink colour which is natural in some varieties can be easily distinguished from the colour of disease. On no account should the cobs be shelled and selection done on the separate grains.

Even where selection has been properly done, seed treatment with a mercurial dust should be a routine practice, the instructions as to quantities being strictly carried out. Several dusts are easily obtained.

To lessen the carry-over of infection from one season to another, old maize stalks should never be left to rot in the lands, but should be burnt or thoroughly composted or ploughed deep. Heavily infected lands should be rested from Maize for several

years, and indeed it should be well known that apart from the question of disease, it is bad practice to grow the same crop often in the same land.

CULTURAL PRACTICE IN RELATION TO DISEASE.

Long rotation is only one of the measures which help to prevent disease in crops. The variety of the crop, drainage and cultivation of the soil, fertiliser applied, time of sowing and harvesting, storage conditions and general hygiene about the farm, all decrease or increase disease, according to whether they are right or wrong.

The farmer has this type of prevention in his own hands but nothing can be done about the weather, and very often in spite of excellent cultural practice some diseases appear almost automatically, e.g. Early Blight of Potato. Many farmers know from experience which diseases are likely to appear and should always spray where this is known as a means of control. It must be remembered that spraying is nearly always *preventive*, and should be started before the disease appears.

SENDING DISEASED SPECIMENS FOR EXAMINATION.

The Chief Plant Pathologist has issued a leaflet giving instructions on how to send in diseased plant material when asking advice. Copies can be obtained on request from the laboratory in Borrowdale Road.

Briefly, specimens should be properly packed with plenty of newspaper or other material, to fit without movement in a box or tin. Soil on roots should be wrapped up well to prevent it from reaching leaves or fruit. Complete plants should be sent where possible. Specimens should be sent as soon as a disease becomes obvious, *before* the plants are completely dead. As shortage of staff makes it impossible for everybody asking advice to be visited, full information should always be sent as to symptoms, amount of infection, soil type, rainfall, fertiliser used and any other relevant details. Last but not least, the name and address of the sender should also be included.

NATIVE AGRICULTURAL NEWSPAPERS.

Attention is drawn to the newspaper Murari or Umlayeli (Adviser) published free by the Natural Resources Board. It has been running for about a year issued every two months, and a copy of No. 6 has just been sent to every European farmer in the Colony with the object of introducing it to agricultural natives working in European areas.

The Harvester (Mukowhi or Umvuni) published by the proprietors of the Bantu Mirror, price 1d. (free for the first few numbers) has just appeared and will be issued fortnightly.

Both these papers are partly in English, Shona and Sindebele and concentrate mostly on agricultural matters. They are non-political, and are issued in the hope that they will help native agriculturists to take an interest in, and to understand the reasons for proper farming methods and conservation of the soil.

APPOINTMENT OF CENTRAL AFRICAN SCIENTIFIC LIAISON OFFICER TO THE UNITED KINGDOM.

As previously reported in the Press Mr. R. McChlery, B.A., B.Sc., of the Agricultural Chemistry Department, Salisbury, has been seconded to the Central African Council from July 10th to take up this new appointment in London, where he will share the British Commonwealth Scientific Offices with the scientific liaison officers of Australia, Canada, India, New Zealand and South Africa. Such an arrangement has been found to foster valuable collaboration, exchange of scientific information and mutual reinforcement between the scientists of the several Commonwealth nations. Representation in the London scientific liaison centre will give the Rhodesias and Nyasaland a unique opportunity to tap the important sources of research information in Britain and the Commonwealth.

Mr. McChlery's duty broadly will be to procure information in all branches of science which may be requested by or of interest to, Government Authorities in Central Africa; he will also disseminate in Britain information on the research needs, problems and progress of Central Africa, and be available to assist scientists paying official visits to the United Kingdom from these territories. In this work he will maintain close touch with Rhodesia House and the Colonial Office.

Mr. McChlery will be undertaking liaison work in all branches of science, and Agriculture will share the advantages which this appointment is certain to bring.

Before leaving for London in August Mr. McChlery will tour the three territories to establish contact with technical departments.

Advice to Cotton Growers

(From the Cotton Research and Industry Board, Gatooma).

TREATMENT OF THE 1947-48 COTTON PLANTS AND LANDS.

(1) *As soon as* the last of the 1948 season's cotton crop has been picked the plants should be uprooted and burnt or, alternatively, utilised for compost-making.

(2) Immediately after destroying the plants the surface soil of the cotton lands should be pulverised, to a depth of at least four inches. This work is better done by disc harrow or similar implement than by plough, as the object in pulverising the surface soil is to crush or expose to dessication the small dormant earthen cocoons, which measure approximately ¾" x ½", and which contain a major pest of cotton, namely the Sudan or Red Boll worm. For maximum effect, a second discing at right angles to the first may be done.

Any delay in pulverising the surface soil increases the chance of a greater carry over of the pest to the following season's cotton crop when this is in its early stage of flowering and fruiting, in this case the young crop of the 1948-49 season. The carry over of the insect from one season to the next is by means of the cocoon stage. In this instance, moths hatch from the *undestroyed* cocoons in the 1947-48 cotton lands and flight to the 1948-49 young cotton crop. These moths lay eggs, from which bollworms hatch, and these in turn form cocoons from which moths of another generation emerge. It is, of course, the bollworms which eat, and so destroy, cotton flower buds, flowers, and green bolls.

(3) In preparing the 1948-49 planting programme, plans should be made to sow maize in the lands in which cotton has been grown in 1948. In the maize growing areas maize should follow cotton in the rotation. It has been found that the yield of maize crops following cotton is greater by about 2 to 3 bags per acre than maize crops which are planted after sunnhemp ploughed under as a green manure.

TREATMENT OF THE 1948-49 COTTON LANDS.

(a) An application of 5 to 7 tons per acre of farm-made compost should be ploughed under in the land in which cotton is to be planted in 1948-49. The soil chosen for this purpose should have good drainage. It has been found that compost not only increases the yield of seed cotton per acre, but that it also enhances the yield of the maize crop which follows cotton in the rotation.

(b) Orders for cotton seed for the planting of the 1948-49 crop should be placed by September, 1948, with the Secretary, Cotton Research and Industry Board, P.O. Box 124, Gatooma. As will be seen from the information published with these notes, the price to be paid to growers for the 1949 crop of seed cotton has been increased. It is probable, therefore, that there will be a keen demand for cotton seed for planting.

(c) It is important to PLANT the cotton crop EARLY in WELL DRAINED LAND.

INCREASED PRICES OF SEED COTTON.

The following are the increased prices of seed cotton from the crop planted in 1948 and harvested and delivered to the Ginnery at Gatooma on or after April 1st, 1949.

Class	Seed Cotton (per lb.)	Equivalent Value of Lint after Ginning
(i)	9¼d.	27d. per lb.
(ii)	8¼d.	24d. per lb.
(iii)	7d.	20d. per lb.
(iv)	5¼d.	15d. per lb.

New Growers are asked to avoid confusion over the terms "Seed Cotton" and "Cotton Lint": as it comes from the field it is known as "Seed Cotton," and after the seeds have been removed in the Ginnery, the fibre is known as "Cotton Lint." It must be emphasised that it requires 3 lb. of Seed Cotton to produce 1 lb. of Cotton Lint, which is the commodity always quoted in market reports of cotton prices.

SEED FOR PLANTING.

Free: The Board will also award to any new Grower "up to" one bag of acid delinted seed.

Intending growers, who have not already done so, are requested to place their order soon for seed for the coming Season. The following are available:—

Type of Seed	Planting Rate per acre	Price per 100 lb. f o.r. Gatooma	Net Weight per bag
(1) MACHINE DELINTED (fuzzy) (suitable for Hand Planting)	25 lbs.	10/-	100 lbs.
(2) ACID DELINTED SEED (non-fuzzy) (suitable for Machine Planting)	15 lbs.	25/-	150 lbs.

STOCK FEEDERS.

Stock Feeders and Dairy Farmers requiring cotton seed for stock feeding purposes, are strongly urged to grow a cotton crop as no undertaking can be given to supply cotton seed for feeding purposes to Non-Growers.

Price of cotton seed for stock feeding — £7 10s. 0d. per ton.

Bulletins giving further information on the planting, management, and marketing of the crop may be obtained from the Cotton Research and Industry Board, P.O. Box 124, Gatooma.

The Use of Timber in Fencing

By THE DIVISION OF FORESTRY.

Introduction.

The object of this bulletin is to shew how wood may be used as a substitute for iron straining posts, standards and droppers which at present are not readily obtainable. It may even lead to wider use of wooden fences for internal purposes such as paddocks if not for boundary fences.

A fence normally serves two main purposes viz. (1) To exclude or confine man and animals, and (2) to define areas such as farm boundaries. In the case of internal fences, the latter falls away.

Wooden fences have not been used on a large scale in the past chiefly on account of the frequency with which straining posts, standards and droppers have to be replaced and because specifications for Government fencing require iron straining posts, standards and droppers. A further reason, not entirely correct, is that wooden fence posts burn readily.

Semi-permanent Wooden Fences.

It must be emphasised that the usual dimensions for fence posts are from 3½ inches to 5 inches in diameter. Poles of these dimensions consist usually of sapwood and no sapwood is durable. To make a fence semi-permanent it is necessary to adopt one of the following three procedures:—

(1) Use live fences.
(2) Use durable species.
(3) Use preservatives to prolong the life of the poles.

Live Fences.

It is well known that many trees grow readily from cuttings or truncheons. Most natives know these trees but, as a guide, those trees which lose their leaves early in the season and/or those with milky latex usually strike readily: The following is a list of the more common ones:--

Rauwolfia inebrians.	Mukashu, mukadhlwa.
Ficus spp.	Wild Fig, mukuyu, mapawa.
Pterocarpus angolensis.	Bloodwood, mukwa, mubvamaropa.
Commiphora spp.	Minyela, mucha, chibobo.
Kirkia acuminata.	Mushamina, muvumira, mtuva.
Lannea discolor.	Mushamva, mubumbu, muvumba.
Erythrina tomentosa.	Kaffir, boom, mutiti, murungu.
Erythrina humei.	Kaffir boom, mutiti.

Cussonia spp.	Cabbagetree, mufenje, muchaka.
Sclerocarya caffra.	Marula, muganu, mupfura.
Euphorbia spp.	Euphorbia, mukondwe, mutatarimbo.

Truncheons should be not less than 6 feet 6 inches long by about 4 inches diameter. They should be cut in late winter or early spring with late August and early September as the best times. The correct time, however, varies with species and the nature of the season. The best guide is to watch the dormant buds. Before they burst to produce the next season's leaves, they swell appreciably. As soon as this swelling commences is the ideal time to cut them.

Truncheons should be reasonably straight — at least in one plane. The upper or thin end should be sawn or cut straight across while the thick end should have a slanting cut — thus exposing a greater area of "cambium" or growing tissue. It is important that the bark is not frayed or separated from the sap wood.

Holes to receive these truncheons should be prepared in advance and be not less than 12 inches square and about 2 feet deep. Only top soil should be filled in. The truncheon is then planted to a depth of 18 inches and firmly tamped. Plant the truncheons as soon after preparation as possible.

The planted truncheons invariably start sprouting immediately but this is not necessarily a guarantee of success. The growth comes from dormant buds which derive nourishment from the sap in the truncheon. Within about 6 months those not destined to strike will have died. With care, at least 50% success may be expected.

Iron standards are usually espaced at 45 feet intervals. Since not all truncheons will strike, the espacement of 20 feet is recommended. All failures should be replaced during the following spring.

The strands of wire, having been strained, are then affixed to the growing truncheons by means of staples.

Durable Species.

The heartwood of many indigenous trees is durable or semi-durable. These trees are:—

Afromosia angolensis.	Muwanga.
Copaifera mopane.	Mopani, musaro.
Acacia nigrescens.	Knobthorn, m'kai, katogwa.
Albizzia spp.	Mugarayense.
Combretum spp.	Mchili, muyando, mchenalota.
Terminalia sericea.	Mangwe, muhonono, mususu.
Faurea saligna.	Mutsetseti, mpemberu, mrere.

Pterocarpus angolensis.	Mukwa, mubvamaropa, umvagasi.
Diplorrynchus mossambicensis.	Mtoa, musikanyimo.
Parinari mobola.	Hissing tree, muchakata. muhacha.
Copaifera coleosperma.	Rhodesian mahogany, mtjibi, muzauri.
Baikiaea plurijuga.	Mukusi.
Burkea africana.	Mukarati.
Dalbergia melanoxylon.	Mugweye, mugwiti, mungara.
Olea verrucosa.	Wild Olive.
Bridelia micrantha.	Mudzinza, mutsungunu.
Trema guineense.	Mputiputi, fredi.

Most of the commonly grown eucalypts and Cedrela toona have durable heartwoods. The bark of these durable hardwoods is always subject to borer attack while the sapwood is subject to early decay.

The bark must always be removed and it is advisable to remove the sapwood with an adze. Failing this, the fence posts should be split vertically into two, three or even four pieces depending on dimensions. The strained wires are affixed by means of staples and are attached to the exposed heartwood.

Preservative Treatment.

A good preservative should possess the following qualities:—

(1) It should be toxic to insects and fungi.

(2) It should be permanent.

(3) It should be readily available in large quantities and be cheap.

(4) It should penetrate timber readily.

(5) It should be non-poisonous to humans and animals.

(6) It should not corrode metals.

(7) It should not render the wood more inflammable.

Impregnation is carried out usually with oil or water-soluble preservative.

Oil Preservatives.

Creosote. This is a distillate of coal tar or coke-oven tar. It is a brown to brownish-black oily liquid with a characteristic odour. For efficient preservation, an absorption of half a gallon per cubic foot is necessary in the case of hardwoods (eucalypts, msasa etc.), and rather more in the case of softwoods (pines, cypresses etc.).

Fuel Oil: Has no toxic value against fungi. It prevents splitting and more or less waterproofs timber—thus helping to keep the moisture content low.

When the above two oil preservatives are combined (75% creosote and 25% fuel oil by volume) a really effective preservative is obtained which fulfils the requirements detailed above to a high degree.

Water-soluble Preservatives.

These are generally cheaper and easier to transport but, being soluble in water, they leach out during the rainy season and lose their toxicity.

Of the commoner ones zinc chloride is effective against fungi and borers, but not against termites or white ants; copper sulphate is very soluble and so leaches too readily, and is corrosive to metals, mercuric chloride is corrosive to metals and too poisonous for average use while sodium fluoride is seriously corrosive with metals, is not readily soluble and is expensive. One is, therefore, reduced practically to arsenic salts though, even here, there is a danger where domestic animals are concerned, though this can be overcome as explained later.

Preparation of Poles for Treatment.

Since damage to poles while drying may be done by fungi and insects, the best time to cut poles is in the winter months when these destructive agencies are least active.

On being cut the poles should be barked for this eliminates bark borers, aids the drying out and the removal of bark is usually much easier and more thorough when freshly felled. It is important that all pieces of underbark be removed for these constitute vulnerable spots even in treated timber.

If water is readily available in the form of a dam or river, the freshly cut and barked poles should be immersed. As the sap in the cells is released, water enters. After several weeks most of the sap will have been replaced by water.

Stacking to Dry.

Whether the poles have been immersed in water or not, they must be stacked for drying prior to receiving preservative. The drying site must be in the shade with free access to air currents.

Two poles are laid on bricks or stones. On these, and at right angles to them, other poles are laid in such a way that the space between adjoining poles is about equal to the diameter of the poles. The next layer is commenced at right angles to the previous one and so on.

Poles of 5 inches diameter should be stacked for averagely 6 months by which time they should be dry enough to absorb the requisite amount of preservative.

Creosote or Creosote-Fuel Oil Treatment.

This is carried out by heat. The containers most readily available are 44 gallon petrol drums. It is best to have two welded together so that the fence posts can be completely covered

by the preservative. If only one drum is used, it entails treating one end of the fence post first and then inverting the post to treat the other end.

The drum or drums are placed over a trench or stones to enable heat to be applied. The poles are then stacked vertically in the empty drums and then the preservative is added. The fires are lighted and the preservative is brought to the boil, kept at that temperature for 2 hours when the fire is withdrawn and the poles are left in the cooling preservative for 20 hours. It is during the cooling process that most of the absorption takes place.

Rate of Absorption.

This differs from pole to pole depending on several factors such as species, percentage heartwood, number of knots and rate of growth but chiefly depends on the degree of seasoning. A well dried, air-seasoned pole suitable for a standard will absorb averagely 8 lbs. of creosote-fuel oil mixture and about 6½ lbs. of creosote if used pure. This is in excess of half a gallon per cubic foot and is, therefore, satisfactory to ensure a life of about 20 years in the ground.

Creosote Supplies.

Creosote has to be imported from overseas and is difficult to obtain at present chiefly on account of the shortage of drums and shipping difficulties. But supplies are beginning to trickle through. Recently a Salisbury firm was quoting 3/2 per gallon in 44 gallon drums. As supplies and transport difficulties improve, prices should drop accordingly.

Arsenic.

Arsenious oxide and sodium arsenite are the commonest forms of arsenic used. The latter is an ingredient of cattle dip and is the one recommended. The mixture recommended is half a gallon of pure liquid to 10 gallons of water.

The seasoned poles are immersed in the dip for about a week. They are then removed, allowed to drain and stacked to dry. During drying, minute cracks will appear and it is, therefore, advisable to immerse again after about a week for a further three days or so.

This is an easy method of treating but has two disadvantages. The first is that the arsenic is poisonous to animals and the second is that, being readily soluble in cold water, the arsenic is leached out by rain and the toxicity is thereby lessened, and the danger to stock increased.

The remedy is to waterproof the poles and this can be done by brush painting them with creosote, creosote and fuel oil or even sump oil.

Straining Posts and Droppers.

So far, only standards have been considered. Straining posts are inserted at corners and at quarter mile intervals. They are

usually 8 feet x 6 inches — 9 inches diameter. If durable species cannot be used, non-durable ones may be treated as described above.

Droppers are hung three between standards and, being 4 feet in length, they are not in contact with the ground since their function is to keep the strands of wire parallel. They are therefore easily replaced and it is not so essential to treat them. Their thickness is from $\frac{3}{4}$ inch - 2 inches and they consist always of sapwood. Split bamboos are often used. But it will be found economical in the long run to treat them as well.

A Compromise.

If no facilities are available for treating, the following method may conveniently be adopted. A fence is erected consisting of well seasoned but untreated poles. Along the fence, trees are planted at about 10 feet intervals. If fast growing species of eucalypt or pine are used, these will often be sufficiently established to act as standards in the third to fourth year when the untreated poles will have served their purpose.

The Economics of Treatment.

On an average, creosoted poles cost about 2/6 per cubic foot in situ as against about 1/- for the seasoned but untreated pole. If the latter lasts for three years, then the creosoted pole must have a life of 9 years to justify the extra cost. From experience in the Colony, a creosoted pole will last well over nine years. They have been proved to last for 20 years in the Union and there is nothing to suggest that a similar period may not be counted on in the Colony.

A Charcoal Safe or Cooler

By B. G. GUNDRY, A.I.Mech.E., Agricultural Engineer.
Irrigation Department.

A charcoal safe or cooler cannot be regarded as a substitute for the ordinary refrigerator, but it will be found extremely useful by those who do not possess one of these appliances, since it provides a means of storing perishable foodstuffs such as meat, milk and butter, etc., at a temperature appreciably below that of the surrounding atmosphere.

Briefly, the safe described hereunder consists of a rectangular iron framework set on a concrete base, and covered on the inside and outside with ½ inch or ¾ inch mesh wire netting in such a way, that a space or cavity 3 inches wide is left between the inner and outer netting. This cavity is completely filled with small lumps of charcoal which thus form the walls of the safe. A doorway is left in one wall and the door itself consists of a wooden framework covered on both sides with wire netting with the space between also filled with charcoal. A shallow water tank supported by the framework completely covers the safe.

In operation, water from the tank is allowed to trickle on to the charcoal so that it is kept wet from top to bottom. As the water evaporates from the charcoal, it absorbs heat from the surrounding air which is thus cooled as it percolates through the charcoal to the interior of the safe. The safe functions most effectively in hot, dry, breezy weather. When the air is still and humid, it is not so effective, but fortunately such conditions do not often persist in this Colony.

The best site for the safe is in the shade of large evergreen trees, where it will be exposed to the prevailing wind. If no suitable tree is available a thatched shelter can be built over the safe as shown in the accompanying photograph. The safe should not, for obvious reasons, be placed where it will catch the dust from a nearby road or yard; if possible it should be placed on a small eminence or other well drained site. The site should be cleared of vegetation, and if necessary,. levelled off. A shallow excavation is then made 2 or 3 inches deep and 5 feet square. In this excavation eight 12 lb. fencing standards, six feet long, are driven into the ground as shown in the plan, so that they form the corners of two squares, one within the other, the inner one having sides 3 feet 6 inches long and the outer one having sides 4 feet long.

Four more standards are driven in on one side to form the door opening, which should be 2 feet wide. Whatever fittings, such as hinges or fastenings, which are to be attached to them, should be fixed before they are erected.

All the standards should be driven in perfectly straight so that they project 5 feet 1 inch from the bottom of the excavation. A spirit level should be used to ensure that they are all set at exactly the same height.

As will be seen from the drawing, twelve "H" section fencing droppers are placed four on each side and four at the back to form intermediate supports for the wire netting. As the droppers are only four feet long it is necessary to use one and a half droppers at each point. The half droppers should be driven in at the positions indicated in the plan and left projecting 1 foot 7 inches from the bottom of the excavation. Whole droppers are then bound on to these as will be described later.

The concrete base may now be poured. The mixture should consist of one part cement, three parts sharp clean river sand and six parts hard clean stone broken to pass through a ¾ inch ring. If stone is unobtainable the whole job can be done with cement and sand only, one part of the former to five parts of the latter being used.

The bottom of the excavation should be thoroughly wetted before the concrete is placed. Four pieces of board may be placed round the edge of the excavations to form a frame to retain the concrete until it sets.

The concrete should be thoroughly mixed, first dry and then with just sufficient water to make it workable, and placed in position as quickly as possible; it must be tamped solid and worked into close contact with the standards and droppers. The layer of concrete should be about 3½ inches thick, and as soon as this is in position it should be covered with a layer of cement mortar (1 part cement to 4 parts sand) ¾ inch thick.

The surface may be smoothed with a trowel or float, but the centre of the base should be left slightly higher than the edges so that water will not lie in pools inside the safe.

The drain and ant trap must be moulded immediately, before the cement commences to set; this can be done by roughly cutting out a semicircular channel about 2½ inches wide and ½ inch deep with a trowel and finishing it off by rubbing it smooth with a bottle guided by a straight edge. Care should be taken to make the bottom of the channel quite level, as its object is to form a canal, or "moat," round the safe to prevent ants and other insects crawling into it.

At one corner of the base the concrete can be extended a few inches to form an outlet channel to carry any surplus water clear of the base. A small neck should be moulded in this channel over which the water will flow, only when the ant trap or "moat" is practically full.

When the base has been completed it should be covered with sacks or grass and kept continuously damp for at least 3 days to allow the concrete to harden properly.

The next operation is to fix the droppers round the inner square to support the netting on the inner side of the charcoal wall. The vertical droppers are bound to the half droppers projecting from the concrete base with baling wire so that their upper ends are at the same height as the standards. Horizontal droppers are fixed at the top and half way up the sides; a single dropper is placed over the doorway. These are all securely bound to the standards and to each other with baling wire to form a rigid framework.

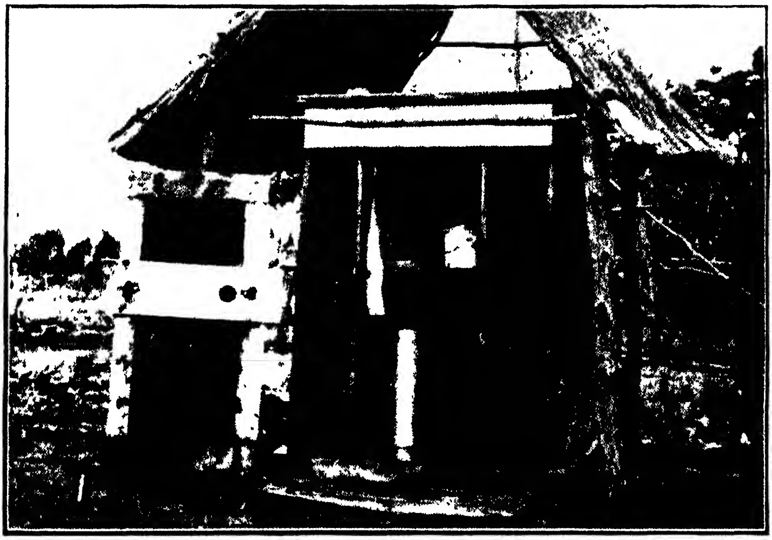
This inner framework is now ready for covering with ½ inch mesh wire netting. This can be obtained in various widths including 3 feet and 2 feet which, if used together one above the other and allowed to overlap by 3 inches in the middle will result in little waste, as the standards project 4 feet 9 inches from the base. Nine yards of each width of wire netting will be sufficient for the job, excluding the door, which will require a further 10 feet of the 2 feet width. The wire itself should be of 20 gauge, as netting made from thinner wire is rather fragile.

The 3 feet wire is wrapped round the inner framework, one end being brought opposite to one of the inner doorway standards to which it is securely laced with baling wire, the unused part of the netting can be left rolled up near the opposite door standard while the 2 feet wire is being wrapped round above it in a similar manner.

The droppers for supporting the wire on the outside of the wall are now tied in position, the upper horizontal ones being placed about two inches lower than the top of the standards to give access to the wires or thorns which control the flow of the water from the tank, as will be described later. When the droppers are all fixed the wire netting is brought round the outside doorway standards and is wrapped round the outside framing back to the starting point where it is tied to the first doorway standard. The outer covering of wire must be tied at intervals of a few inches to the standards and droppers, and links of baling wire should be passed round the inner and outer droppers every six or eight inches to keep them the proper distance apart.

The space between the inner and outer wire netting may now be filled with charcoal. This should be broken into small lumps from 1 inch to 1½ inches across. All dust and small pieces should be removed by sifting through a ½ inch or ¾ inch sieve. (A piece of the ½ inch wire netting can be used for this purpose). The charcoal thus prepared should be washed in clean water and may then be filled into the walls while still wet. It should be evenly distributed, but need not be packed in too tight.

The door should next be made and fitted, it can be made to lift right out as shown in the drawing or may be hung by two 18 inch Tee hinges, which must be rivetted or bolted to one of the fencing standards forming the door posts. The framework



A Charcoal Safe as described in this article, built by Mr. John Dennis, of "Pendennis," Mount Pleasant.

of 3 inch by 2 inch timber and 6 inch flooring boards is covered on both sides with 2 feet wire netting and filled up with charcoal. The door shown in both the accompanying drawing and photograph is secured by a long locking bar which is passed through the holes in the two projecting plates rivetted to the standards and which project through the slots cut in the centre cross piece of the door when it is in the closed position. A padlock passed through an eye in the end of the locking bar makes the safe reasonably burglar proof.

It is presumed that the water tank will have been obtained from a plumber. The holes in the bottom should be punched with a 2 inch wire nail from the inside, in straight rows 1½ inches from the edges and 4 inches apart. They should then come exactly over the centre of the charcoal walls when the tank is placed in position, standing on the top of the standards.

The successful working of the safe depends on keeping the charcoal just wet from top to bottom without having a large excess of water running to waste. Unfortunately the regulating of the flow of the water, through the holes in the tank, to the proper speed--usually found to be a fairly fast drip—is not not an easy matter. Mimosa thorns and match sticks are frequently used, but these tend to soften and block the holes entirely, and the writer would suggest the use of short lengths of 12 or 14 gauge galvanised wire with their ends bent into loops to prevent them falling out of the holes. Wicks made of soft string should also prove fairly successful.

Any dust or rubbish which finds its way into the tank will tend to choke the holes and make the regulation of the water more difficult, and for this reason the tank should be provided with a lid made of sheet iron or flooring boards.

A hole in the lid to take a fairly large funnel (fitted with a fine gauze if possible) will facilitate the filling of the tank and help to prevent the admission of dust.

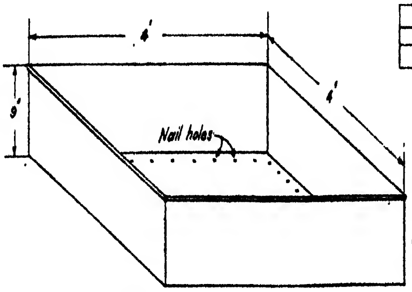
An ordinary maximum and minimum thermometer kept in the safe will indicate if the safe is working properly and what flow of water gives the best results. Under ordinary conditions the temperature in the safe should not rise much above 60° F.

A single shelf can be supported on the two centre horizontal droppers or a set of shelving can be built independently to fit into the safe.

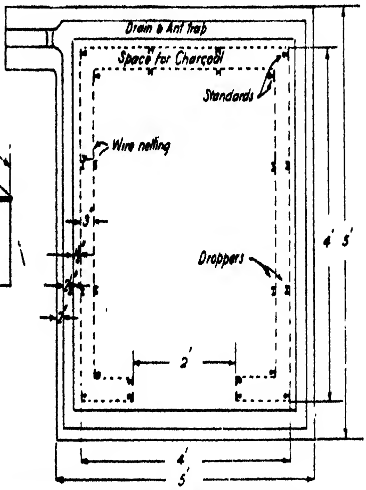
Should the charcoal become fouled by the use of impure water or other causes it can be removed by untying the outer covering of the wire netting and replaced with fresh charcoal.

The safe can be made larger or smaller than the one described to suit individual requirements.

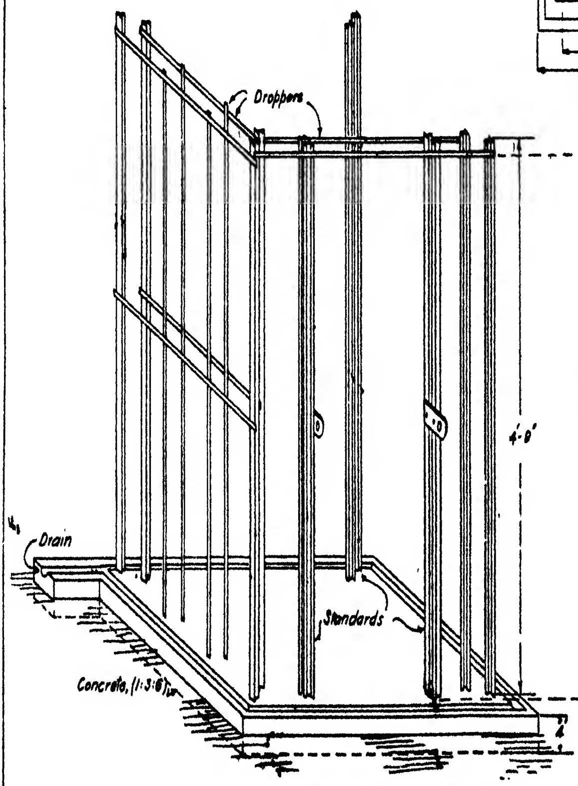
The writer is indebted to Mr. John Dennis for permission to publish the accompanying photograph which shows the safe recently built by him on the lines suggested by Mr. J. R. Camp in an article published in this journal in March, 1926, with certain minor improvements which have been incorporated in this article.



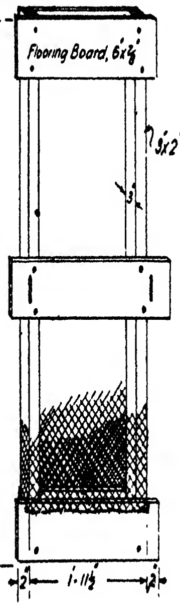
Water Tank of 24G. Gal. Iron.



Plan of Concrete Base, showing arrangement of standards & droppers



Perspective view showing standards erected and droppers fixed on near side only, others must be fixed in the same manner to the back and far side.



Door.

CHARCOAL SAFE

Irrigation Division
Salisbury
ASS 12.11.33.

Soil Reaction in Relation to Plant Growth

Reprinted from the Journal of Agriculture of South Australia.

(Read at Conference of Kangaroo Island Branches).

By W. B. KELLY, Pioneer Bend Branch.

The soil reaction is an important chemical characteristic of soils. It indicates to a certain extent the nature of the internal chemical processes of soils, which determine the state or condition of soil fertility.

Soil reaction may be defined as the degree of acidity or alkalinity of the soil. That is to say that not only may soils be either acid, neutral or alkaline, but also that they vary in their degree of acidity or alkilinity.

Now this probably all sounds a bit complicated, and not really worth worrying about, until it is pointed out that plants vary in the particular reaction that they like best. So that it becomes worth while to know (a) what crops like which soils, and (b) what soil reaction we are likely to have on our particular farm.

Unfortunately, to know this we first have to know what we are talking about. So let us go back a bit. Now in the good old days we talked about "sweet" soils, and "sour" soils just as if people really ate them. We weren't at all sure what we meant, and certainly nobody else was. Then we realised that perhaps it sounded better if we said that soils were "acid" or "alkaline" but we still weren't positive. At last scientists came to the rescue and gave us the pH scale. And now, if we really want to, we can describe soil reaction fairly accurately.

The pH Scale.

This pH scale is merely a simple means of measurement. The brainy people among our forefathers got sick of measuring things with their fingers so they evolved a foot ruler and divided it off into inches. And similarly modern scientists got tired of saying that substances were merely "acid" or "alkaline" when they knew that some substances were a lot more "acid" or "alkaline" than others. So they drew the pH scale which is produced herewith (Fig. 1), with various well known substances marked opposite the point where they normally reach. Now about the middle of the pH scale you will see the neutral point, pH 7. When anything is tested for reaction and is neither "acid" nor "alkaline," it is said to be neutral, and has a reaction of pH 7. Substances are

tabulated according to the degree of their acidity on the top side of the scale among the smaller numbers. Thus you will see that vinegar for example has a pH value of 3.1. Other things which give an alkaline reaction have a pH value above 7 and are tabulated according to their degree of alkalinity. Thus washing soda for example has a reaction of pH 10.6.

Now if you glance at the right side of the scale you will see that soils do not go to either end of the scale, but vary between pH 4 and pH 10; while as far as crops are concerned they only grow well between about pH 5.8 and pH 8.5.

Every kind of plant is believed to have a most suitable range of soil reaction (or pH range), for its best growth. Here is a list of plants and along side each is the pH range at present believed to be best suited to it.

Cereals.

Plant	Optimum pH range
Wheat	6.5—7.5
Oats	5.5—8.5
Barley	7 —8.5
Peas	6.5—8.5
Rye	6 —6.5

Pastures, Etc.

Burr Clover	7 —8.3
Subterranean Clover	6 —8
Lucerne	7 —8
Brome	6 —8
Perrennial Rye	6 —8
Evening Primrose	6.5—8
Sorrel	4.5—6.5
Rape	6 —7.5
Field Turnip	5.5—6.8

Fruit and Vegetables.

Apple	5 —6.5
Pear	6 —7.5
Peach	6 —7.5
Potato	4.8—6.5
Tomato	5.5—7.5
Cabbage	6 —7.5
Cauliflower	5.5—7
Strawberry	5 —6.5

Now this list is well worth studying. It will be seen that some plants grow best in a rather narrow pH range, e.g., rye pH 6—6.5. But others are not so particular, e.g., oats pH

5.5—8.5. However they all have a range of soils in which they will grow best. Before we get away from this list for the time being it may be as well to make some observations on the pH range for sub clover. You will note that its range on the list is pH 6-pH 8. While this is no doubt so, it has frequently been noted that subterranean clover tends to give way to burr clover in alkaline soils, and it has become evident that a good deal of effort is wasted in persisting with subterranean clover above pH 7.5, when barrel clover makes a more suitable legume in these soils. But below pH 7 subterranean clover has proved invaluable. Therefore, while the pH range of subterranean clover may be from pH 6 to pH 8, it is worth while noting that other legumes suitable to our climate grow well above the neutral point, while below pH 7 we are largely dependent on subterranean clover.

Assessing the pH Value of Soils.

You may well be thinking that so far this is tolerably interesting but it is not of much value because, after all, we do not know the pH value of our own particular land. So that it becomes a question of how we can assess the pH value of any particular soil.

Without claiming to be an authority on the subject, let me give you a few clues. Firstly, it is recognised that the soil reaction has a definite relationship to the climatic conditions under which the soil was formed. Originally most soils contained much calcium. As time went on, especially in the high rainfall areas, the replaceable calcium ions have been removed by leaching and replaced by hydrogen ions. The reaction of the soil is determined by the relative ratios of hydrogen and calcium ions. Now the points in that little discourse that interest you and me are, firstly, that limestone is composed mostly of calcium, and it naturally follows that soils containing free limestone have not leached as much as those without it, and these limestone soils are alkaline in reaction. In fact, when there is a good deal of free limestone about the pH range is usually somewhere about pH 8-pH 8.3. So bear in mind that the more limestone there is about, the more alkaline the soil usually is.

Secondly, high rainfall areas are usually more leached than arid areas, and their soils usually tend to be acid; whereas arid soils tend to be alkaline.

Perhaps at this stage if we glance at that list of the pH ranges of plants we may be able to get a few more clues. You will note, for instance, that sorrel has a range of pH 4.5 to pH 6.5. It will be seen that if sorrel volunteers on any part of your farm then that part is almost bound to be acid and will probably be somewhere below pH 6.5. On the other hand, if burr clover volunteers readily, you may be pretty sure that the soil concerned is alkaline and above pH 7. And if you note other plants and their ranges you will soon form a fairly accurate idea of the pH value of the soil on your farm. After a while you will get quite good at it, and note that natural vegetation also has a pH range which you will be able to work out.

Select Plants According to the Soil Reaction.

And where does all this get you? Well, rather obviously the general idea is to grow those plants best suited to the pH value of your soil. If you live in limestone country with a pH value around 8, stick to growing barley and oats for cereals and barrel clover and lucerne for legumes in your pastures. At least, that is the general idea.

It is worth while to keep to those plants suited to your pH value. If you live near me where the pH value is 6, and if you must grow cereals, stick to oats or perhaps rape, turnips, and rye; but if you do not want to dodge your income tax, you can fill in time growing subterranean clover and ryegrass.

And if you live about Cygnet River in the pH 7 or neutral zone, you have a wider range to choose from. Grow what you will, but do not ignore the pH ranges of plants you grow.

Correcting the Soil Reaction.

So far I have recommended sowing those plants best suited to your soil. But supposing that you would like to grow some other plant with a pH range which does not include your soil. Well, if you wish to remain financial, my advice is to try and think of something else. Of course, if it happens to be in your garden, and you do it for fun, or to please your wife, then you will get pleasure out of correcting the condition of the soil to suit your requirements. This can be done in a variety of ways, but at present I will give only the two usual methods of correcting soil reaction. If the soil is acid apply a liberal dressing of lime. And do not forget that it takes a heavy dressing, running into tons to the acre, to have much effect. However, it is worth while noting that in many parts of the world lime is found to be an economical dressing. In England and the U.S.A. huge quantities are used annually. In Australia we are extremely fortuate that we have subterranean clover (which particularly tolerates acid soils) that is suited to our climate, so that under normal farm practice here, applying heavy dressings of lime is not only uneconomical but also unnecessary.

If the soil is alkaline and you wish to acidify it, apply a dressing of sulphur. Thus, if you live in the limestone area of Kingscote and you very much want some of your own home-grown strawberries (which have a pH range of 5 to 6.5) and you do not mind paying for the sulphur, then you will find it will be a big help.

Warnings.

Do not imagine that all you have to do is look up the pH ranges of plants and all will be well. This is no easy method of farming, but may be used as a guide as to what to start with. You still have to supply the plant foods, such as nitrogen, phosphate, etc.

And you still have to take climatic conditions into consideration. These are as important as the pH range. Also, do not

get the impression that certain plants will not grow outside the ranges mentioned. They will, but it probably won't pay you to grow them.

A final warning — do not imagine that you reduce acidity by merely growing legumes, such as clover. The growing of legumes increases the nitrogen content of the soil and does not increase the calcium content. Topdressing slightly reduces acidity by the application of the lime in the superphosphate, but this amount is so small that it will not make any difference for a very long time. So that if you have acid soil, you need to give it a really heavy dressing of lime to alter the pH value. And the moral behind it is that if you live in a pH 6 area, lay off barley and lucerne until a few more generations.

Summary.

The purpose of this paper has been to emphasise that soil reaction has a definite effect on plant growth; also that scientists have evolved the pH scale which is nothing to be frightened of, and which we should understand and use. If we do so intelligently it will help us to decide which plants are best suited to our particular locality. It should, therefore, be worth our while to try and (a) learn the pH value of our own soils; and (b) grow those crops and plants known to be best suited to our particular types.

Irrigation

By K. J. MacKENZIE, Senior Extension Officer.

Irrigation on a large scale at least is a specialised job and unless carried out according to certain definite rules will be so disappointing and unsatisfactory as to appear hardly worth while.

Many potentially good irrigation schemes have been started with high hopes, only to be abandoned after a few years, because of lack of knowledge and inattention to detail in the methods of applying the water.

Haphazard irrigation is unsatisfactory because

(1) It nearly always causes puddling and thus destroys the texture of the soil resulting in poor penetration of water and difficult ploughing.

(2) It is extremely expensive in time and labour.

(3) It frequently causes severe gully and sheet erosion, and very high losses of both soil humus and plant foods.

Advantages. Irrigation is expensive to install, but it gives benefits out of all proportion to the area involved. It is generally considered that land under irrigation is worth anything from £40 to £100 per acre.

The following are some of the advantages to be derived from irrigation.

(1) It provides succulent feed in the dry season, and plays an important part in keeping stock in good health and in providing a bite of green feed for sick animals.

(2) Provides cheap protein in the form of lucerne or other legumes to balance feeds for pigs or dairy stock. Unless protein can be supplied in the form of lucerne, it has to be bought in the form of blood or fish meal which is very much more expensive. The cost of feeding pigs can be reduced by as much as 40% by supplying protein in vegetable form.

(3) Enables valuable catch crops such as Potatoes, Onions, Tomatoes, etc., to be produced at a time when they fetch good prices.

(4) Enables the production of ample green vegetables for household and compound use, and a year round supply of fruit.

(5) If valuable pedigree stock are part of the farming programme almost any expense in the establishment of a reliable irrigation scheme is justified, as it makes the difference often between doing such animals well or badly.

Methods. There are a number of different methods of applying water suited to various soil conditions and land slopes. These methods may be listed as follows:—

(1) Terracing, (2) Free Flooding, (3) Basin method, (4) Cross flooding by means of field furrows between contours, (5) Row Irrigation and (6) Bench and roll for orchards.

A short description of each of these methods is essential at this stage to illustrate the relative advantages and use of each.

1. **Terracing** is by far the most satisfactory method of distributing water because it eliminates all chance of wash, it avoids entirely any waste of water, it results in an even spread of the water over the surface, it ensures good penetration on all types of soils, it eliminates all risk of puddling and lastly it is extremely economical of labour.

It has several disadvantages, but these are far outweighed by the benefits obtained.

The disadvantages are *firstly*; the original cost of making the terraces is fairly high although once made, they are there for

Secondly, since the terraces are usually from 20 to 40 feet wide, heavy equipment such as combine headers, and large ploughs cannot be used, and cultivation must be carried out with reversible or single furrow ploughs or Martin cultivators and disc harrows.

Description. Terraces are benches cut out of the hillside, dead level across the bed, and with a longitudinal fall of from 1-200 to 1-600 depending on the length of the bed and porosity or otherwise of the soil.

Construction. The construction of terraces consists of moving from nil to 9 inches or more soil from the high to the low side of the bed to form a flat surface cut out of the hillside on which water will spread out, and flow slowly, and evenly along the full width of the bed. A small retaining bank on the down slope side prevents the water from spilling off the edge on to the adjoining bed lower down.

Terracing or the moving of soil from the high to the low side of the bed may be carried out in one operation by hand or by the use of a ditcher or a triangle drag or it may be spread over several seasons by using a one way plough, and ploughing down each year. In the latter case, a furrow is maintained along the high side of the bed and used to distribute the water along the terrace by cross flooding until the bed becomes level when the furrow falls into disuse.

Longitudinal Levelling. To ensure even watering it is usually necessary to carry out a certain amount of longitudinal levelling.

This consists of removing any high spots and filling any low spots in the length of the bed to obtain an even fall from one

end to the other. If the quantity of soil to be moved is considerable, dam scoops are the most satisfactory implement for the rough levelling, followed by a land plane or a land leveller.

Before sowing a permanent crop, such as lucerne, the final levelling should be done by hand in front of the water. This is termed water levelling, and consists simply of removing soil from the unsubmerged high spots, and throwing it into the low spots to ensure that the whole bed is covered by water.

2. **Free Flooding** consists simply of ploughing furrows on grade across the land, and using these to distribute water over the field. It is only effective on slopes flatter than 1-75 and even then is liable to cause wash and loss of humus and fertiliser which floats off in suspension or solution. Considerable labour is required, and it is very difficult to prevent boys paddling in the water, and thus causing puddling.

It is not recommended, therefore, except on very flat slopes, and even then much more satisfactory results will be obtained if low banks are constructed on usual grades to confine water to regular strips which then in effect become terraces.

3. **Basin Method.** This consists simply of providing a series of basins separated from each other by low dividing banks, and filling them with water to any required depth.

The basins are level both across and length ways so that the whole enclosed area can be submerged. The obvious disadvantage is of course, the difficulty of carrying out ploughing, mowing, etc., across the banks. A modified method which avoids this disadvantage is to set out the land in terraces in the normal way, and then divide the terrace up into basins, by putting in small cross walls (which can be ploughed out and remade each year) at regular intervals to enable the terrace to be flooded in sections from a furrow carried along either the edge of the terrace or on top of the terrace wall. This method enables a small stream of water to be delivered with practically no seepage loss right to the point on the terrace where it is required, and is therefore very economical of water. In other words, instead of trying to flood a hundred yard bed from end to end with a small stream, the bed is sub-divided into sections of from 30 to 100 ft. each of which is flooded separately from a furrow carried along the edge or the top of the terrace wall.

4. **Cross Flooding between Contours.** To meet the demand for a type of irrigation suitable for wheat lands where heavy ploughing and reaping equipment must be used the system of cross flooding from field furrows between contours was devised.

In this method the field is contoured in the usual way, but to avoid the washing which would occur if the water was allowed to flow from one contour all the way down to the next without interruption, the intervening space between contours is sub-divided by field furrows across the slope at 1 ft. vertical intervals, and

parallel to the contours. In making these field furrows, the ground is thrown up hill to form a small retaining bank by means of a plough or better still a ditcher, and flooding is carried out from one field furrow down to the bank above the next, thus dividing the land up into a series of strips from 10 to 25 yards wide.

These banks and furrows are so small that they do not prevent the operation of combines, and as they are ploughed out and remade each year they do not interfere with cultural operations.

If care is taken to prevent washing in lateral furrows, and if surplus water is disposed of without causing erosion, these measures will qualify the wheat farmer for the full 50% of the bonus on slopes up to and including 1-30.

The other 50% is given for compliance with the green cropping regulations.

The main disadvantages of this type of irrigation are firstly, puddling can take place if care is not taken to prevent natives working in the water, and secondly, on the steeper slopes it is very hard to get adequate penetration on heavier soils in the later irrigations, when the ground has become compacted, and finally it does not wholly prevent the loss of soil and humus as does terracing; but it does confine soil movement to the distance between field furrows.

5. **Row Crop Irrigation.** This is one of the most satisfactory methods of distributing water with suitable crops, provided the rows are set out on correct grade by instruments.

It is very important to maintain an even grade on the rows of not more than 1 in 400, or breakages will occur in the hollows due to accumulations of silt washed down from the steeper sections. Such breakages are apt to cause serious damage to the crops and rapidly develop into gullies, which make it still more difficult to maintain an even grade on the rows. For this reason, and to restrict the extent of the damage, row cropped lands should always be contoured in the usual manner.

Row irrigation is particularly suitable for such crops as potatoes which have to be ridged up in any case thus providing regular channels at close intervals for the easy distribution of water.

6. **Bench and Roll Down.** Where lands are excessively steep and normal terracing would result in a drop from terrace to terrace of 2 feet or more, a modified system of terracing is advised, called the bench and roll system.

This consists of cutting narrow benches usually not more than 6 feet wide at the correct distances apart, to provide room for orchard trees. On steep slopes this frequently means a drop of as much as 6 feet between benches. No attempt is made to work the space between the benches, this is simply left in grass in the form of a roll down. When finished the field looks like a steep piece of grassland with very narrow benches on grade across the

slope on which the trees are planted, and irrigated. Care should be taken to exclude all storm water and the benches should have a substantial wall on the low edge, as they will have to carry storm water from the roll above as well as the water falling on the bench itself.

By this means orchards may be planted with safety on ground which would be far too steep, and too expensive to terrace in the normal way.

General Remarks. When choosing land for irrigation, it must be remembered that good drainage is essential, particularly for such crops as Lucerne. It is much safer to choose a piece of high lying dry red soil with good depth, than to sow on black or yellow vlei soil nearer the stream. Lucerne won't stand wet feet, and if the land swamps during the rains, it will simply die out.

Width and Length of Beds. No hard and fast rule can be laid down for the length and width of beds, as this depends on the porosity of the soil, the slope of the ground, and the quantity of water available.

Generally speaking, it is not considered wise or economical to have a drop of more than 1½ feet between terraces, as this entails moving 9 inches of soil from the high to the low side, making an expensive job and getting perilously near to the subsoil or gravel layer. Therefore on steep slopes, terraces must be narrow enough to keep within this limit. Up to a width of 12 to 14 feet, terraces may be built fairly economically by hand labour, but beyond that, reversible ploughs, Vee drags or ditchers must be used to keep the cost within reasonable limits.

The *second* factor that controls the width of beds is the amount of water available. It should be obvious that if a large stream of 3 to 5 cusecs is available, beds may be as wide as 50 feet, and still be economically irrigated, but a small stream in a bed of this width would fail to travel more than a few yards, however long it was allowed to run. In general, beds may be from 10 to 40 feet wide, but anything narrower or wider than this is seldom practicable.

The length of beds. Beds should be as long as possible to facilitate ploughing, and to reduce the number of lateral furrows required, but the time taken to irrigate a given length of bed appears to increase in the same ratio as the square of the length. In other words, if the length of a bed is doubled it will take 4 times as long to irrigate it, unless the water is carried along the high edge of the bed, and introduced at intervals along the bed as previously described.

The third factor affecting the length of the terraces or beds, is of course the porosity of the soil. In loose sandy soil, beds should be kept shorter than on heavy loam soils. It would appear that a maximum length for flood irrigation is about 200 yards, but if the modified basin method is used, and a furrow carried along the top of the bed and introduced at intervals, it can be increased to as much as 400 yards if this appears desirable.

Quantity of Water. Any quantity of water however small can be used for irrigation if sufficient water-tight storage can be provided. As little as 400 gallons an hour pumped or delivered into a brick or galvanised iron storage tank of say 30 thousand gallon capacity will provide enough water to irrigate two acres or so. It is generally accepted that 220 gallons per hour will irrigate an acre of land if adequate storage can be provided.

Value of Irrigated Land. I should like to reiterate that the value of irrigated land is enormous in the economy of the farm, and justifies all the cost of doing a thorough job of terracing.

Even one or two acres intensively cultivated and irrigated can be made to produce a handsome return not only in valuable crops like flowers, lucerne, potatoes, etc., but also indirectly in supplying cheap protein to balance the ration of pigs, poultry and dairy cattle.

Poor Methods. Haphazard irrigation is expensive in labour, dangerous, and unsatisfactory, and the cost of terracing (which is a permanent job once completed) will pay for itself over and over again, in better returns from the land and reduced labour costs.

Irrigation Layouts. In considering irrigation layouts the question of access to the lands and facility in working should not be overlooked.

There are two methods in general use. In the first of these the water is brought down the main distributing furrow usually on or near a crest, and the beds are pegged to flow away from the furrow in both directions for 200 or less yards where they terminate in a shallow wide grassed drain which provides for the safe disposal of storm water, and of surplus irrigation water, and usually runs straight down the steepest slope at right angles to the terraces.

Immediately beyond and adjoining this grassed drain is a well cambered road which provides access through the shallow drain to the beds on both sides.

This method also permits of ploughing from cambered road up to, and if necessary, across the furrow to the next road beyond a distance of some 400 yards.

In the second method a furrow is provided as before with beds terminating in the same grass drain with a cambered road, but beyond that is another furrow instead of a grass drain, and the beds are all pegged to flow the same way. This permits road drain and furrow combination to be inserted anywhere along the pegged lines of the beds. In the first method because the direction of flow is reversed at the end of each section one is committed to a definite length of bed, and to a fixed point for the grassed waterway and road.

In the second method there are twice as many road, drains, and furrow combinations in the same area, but these can be

inserted anywhere as circumstances dictate, and by the same token the beds can be shortened or lengthened at will, if the need should arise.

Pegging. In pegging it is not as a rule, necessary or wise to peg each terrace. It will be found much easier and more satisfactory if lines are pegged at horizontal intervals wide enough apart to allow of sub-division by measurement into 4 terraces of suitable width.

Thus a variation in width is spread evenly over 4 beds rather than being concentrated in one. Or 3 parallel beds can be set out, and the remaining one given a corrective wedge shape.

For instance on land with a slope of 1 in 40, lines could be pegged at 40 yards apart straightened and then sub-divided by measurement into 4-30 ft. beds with a drop of 9 inches from one to the other.

Never attempt to put in all the lines at once or a forest of pegs will result. Peg and mark the main lines by plough. Subdivide through the centre and mark again before measuring and marking the final lines.

Grades. Grades should not normally exceed 1 in 200 and if the terrace basin method is to be used, can be as flat as 1-600, but 1-300 to 1-400 is about right for most soils.

If grades are steeper than 1-200 the water tends to form runnels and does not readily spread over the width of the beds.

Distributaries. The main distributary furrows down the slope will need protection if the grade is steeper than 1-75 and the cheapest method is to provide concrete stone or brick drops opposite each terrace which serve both as diversion gates, and as protective drops. These are best cast in concrete on a flat surface, on their side, and later carried to the land and planted at the correct places, and the correct height in relation to the bed.

It is not usual or essential to brick-line furrows except on small schemes where the cost is negligible especially as on large schemes it is usual to plough through and remake the distributary furrow each year. The concrete gates being opposite the terrace banks do not interfere with this practice, but a full lined brick furrow would.

General. It is wise to reiterate that the success or failure of irrigation depends on the thoroughness with which it is carried out. If terraces are carefully and properly made on the correct grades, and if the land is deep and well drained, success can be guaranteed, and a very valuable asset to the farm result, but if, on the other hand, the water is simply carried to the field and applied by spilling down the slope, the whole scheme will give such poor results that it will eventually be dropped as uneconomic.

Report on the Preliminary Reconnaissance of the Possibility of Cultivation of Tung Oil Trees in the Eastern Districts of Southern Rhodesia

By C. C. WEBSTER.
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INTRODUCTION.

This report deals with a five-day visit to the Eastern Districts of Southern Rhodesia for the purpose of ascertaining whether conditions of soil and climate there are suitable for the cultivation of tung trees. As a result of this very brief preliminary survey it is only possible to say that, in my opinion, there are distinct possibilities for tung oil production in that area, but before dealing with the observations actually made it is desirable to give some account of the tung tree and its cultivation as this will be needed in considering whether further investigation or development is desirable. The information given below is necessarily brief, but more detail can be obtained by consulting the papers which are listed at the end of the report.

NOTES ON THE CULTIVATION OF THE TUNG TREE.

Species.

2. Tung oil is extracted from the seeds of two species of trees, *Aleurites fordii* and *A. montana*, both of which are indigenous to China and to certain neighbouring parts of South-east Asia. *A. fordii* is a subtropical species which is now extensively grown in the southern states of the United States of America. (1) (2). It has been tried in almost all parts of the British Colonial Empire and also in India, Burma and South Africa and has in general given disappointing results. *A. montana* flourishes under wetter and warmer conditions than *A. fordii* and has been found to be the better species for cultivation in the Dutch East Indies (3), Burma, Nyasaland (4) and South Africa (5). Furthermore, whereas very promising results have been obtained from attempts to improve the yield of *A. montana* by selection and vegetative propagation, the results from similar work with *A. fordii* have been disappointing in the United States, South Africa and Nyasaland (4) (5). For these reasons *A. montana* is the species more likely to be successful in the Eastern Districts of Rhodesia.

Climate.

3. From my experience in Burma and Nyasaland I consider that the essential climatic requirements of *A. montana* are a rainfall of not less than about 40 inches, fairly evenly distributed in the summer months, and a winter cool enough for the trees to shed their leaves and enjoy a dormant period of 3 or 4 months' duration but not so cold that anything more than slight frosts are experienced. Higher rainfall, up to as much as 90 inches, has no appreciable adverse effect and up to 60 inches is certainly beneficial, although the trees will grow well on 40 inches. Practically no information is available on the amount of frost which established trees will stand when they are dormant, but young trees, which do not shed their leaves during the first winter, will only survive very slight frost. Older trees would undoubtedly stand rather more severe frost during their dormant season. In Nyasaland the lower altitude limit for this species is generally about 2,000 feet: the upper limit has not been established with certainty but it is not below 4,500 feet. I should expect the limits to be about the same in eastern Rhodesia, but they will vary somewhat from place to place owing to the influence of topography, etc., on frost incidence.

Soils.

4. There is not much information on the soil requirements of this species beyond the facts that an acid soil is necessary, that it will not tolerate bad drainage, and that reasonable fertility and a depth of 2 to 3 feet are very desirable. In Nyasaland it does best on fertile, deep, red loams but is satisfactory on lighter and poorer soils. Owing to the fact that tung trees have for a very long time been grown by peasants in China on poor, rocky soils, unsuitable for food crops, it has in the past been stated fairly frequently that tung is suitable for poor soils. There is no doubt some truth in this as far as peasant cultivation in China is concerned as the owner expends no capital and little labour and is satisfied with small returns. But where *A. montana* is grown as a commercial plantation crop good yields are essential for profit and can only be obtained by planting budded trees on reasonably good soil or on poorer soils with the help of manures.

Yield Variation.

5. *A. montana* is a relatively long lived species which begins bearing at 3 years old and probably continues cropping for at least 40 years. I have never been able to obtain any accurate information as to the age at which full bearing is reached or how long the trees continue to crop, but from experience in Nyasaland, where the oldest trees are aged 16 years, it seems that seedlings reach full bearing somewhere between the 12th and 15th year, and I should expect buddings to do so rather earlier. In Burma I have seen semi-wild trees at least 35 years old which were still bearing well. When plantations are established with seedlings some 40 to 50 per cent. of the trees are predominantly male and therefore bear very little fruit, while the remainder, known as "bearers," produce a much higher proportion of female flowers and therefore crop more heavily. There is a considerable variation in yield amongst the bearers, many giving only moderate

yields while a small proportion are exceptionally good. (6). Consequently it is necessary to plant budded trees derived from selected high yielders, a procedure which not only eliminates the high proportion of unprofitable males but also ensures that the whole plantation consists of these high yielding clonal trees. The selection of the best mother trees and the testing of the clones derived therefrom is naturally a length ybusiness. In Nyasaland it was begun in 1940 and to date about 750 provisional selections have been made from seedling plantations totalling rather more than 50,000 trees. After the yields of the selected trees have been recorded for several years, buddings are made from the best of them and are tested in clone trials. So far 68 clones are under trial but the oldest of these are only 6½ years old and it will be several years yet before a really discriminating selection of the best clones can be made. (7). Nevertheless, there are a number of clones which, during their first 6 years, have given yields many times greater than those obtained from seedling plantations at the same age.

6. The table given below illustrates the facts mentioned above and gives an estimate of the yields which may be expected from budded trees. It may be mentioned that the highest yield obtained so far from these 123 trees at Zomba was in their 13th year, when the average yield was 22.5 lbs. dry seed per tree, equivalent to 1,260 lbs. per acre. (56 trees per acre). The estimated yields for buddings are based on the actual yields so far obtained from clones under trial and from bearing seedlings. It is assumed that the initial spacing of the trees is 24 feet square, which is now recommended. I think the estimate is a conservative one as several clones have yielded over 1,500 lbs. of dry seed per acre in their 5th and 6th years. Yields are shown as lbs. of dry seed, from which 30-33 per cent. oil would be extracted at the factory.

Table 1. Average yields from a plot of 123 A. montana trees at Zomba, lbs. dry seed per tree.

Age, years:	3	4	5	6	7	8	9	10
1. All trees	1.7	3.6	5.2	9.4	11.8	13.7	15.1	20.5
2. 48 male trees	0.1	1.0	0.5	1.2	2.0	2.3	2.7	5.2
3. 75 bearing trees	2.7	5.9	8.2	14.6	18.1	21.1	23.1	30.4
4. 12 best bearers	4.8	8.7	17.1	27.5	28.4	35.3	33.2	50.8

Table 2. Estimated yields from a plantation of buddings lbs. dry seed.

Age, years:	3	4	5	6	7	8	9	10
Per tree	3.5	7.0	13.0	16.0	20.0	24.0	27.0	30.0
Per acre (75 trees p.a.)	262	525	975	1200	1500	1800	2025	2250

Cultivation.

7. Although *A. montana* cannot be grown without cultivation as a forest tree, its requirements for cultivation and labour are not high. Inter-cropping with tobacco, soya beans or food crops is commonly practised in Nyasaland for the first 4 or 5 years and, provided due regard is paid to the maintenance of soil fertility, is both profitable in itself and beneficial to the trees. A period of thorough cultivation from the 2nd to the 4th or 5th year, when the trees are making their main framework, is undoubtedly desirable, but intercropping cannot be continued after the 5th year owing to the spread of the branches and roots. Thereafter the common practice is to allow grass to grow except for circle weeding the trees, or to plant a perennial leguminous cover crop. If the former procedure is adopted the grass must be cut or hoed once or twice a year and some fertiliser or manure will be needed to replace the nutrients removed by the grass. It may also be found desirable to break and resow the leguminous cover periodically.

Harvesting. Oil Extraction.

8. The fruit falls from the trees when ripe and is collected from the ground. The seeds have to be extracted from the fruits before they are put through the oil expeller and at present this has to be done by hand as there is no satisfactory machine available which effectively removes the seeds from *montana* fruits. This is an important point as husking by hand is relatively expensive, and it is to be hoped that an efficient machine will soon become available. A large machine is in use in Nyasaland for this purpose at present but is unsatisfactory because its capacity is small and its cost high. What is required is a small portable machine which could do the job in the plantations and I understand that such a machine is already in use in *fordii* plantations in America.

9. It is not practicable to express tung oil from the seeds on a commercial scale with any form of small hand press or with a hydraulic press, as such machinery will only extract a part of the oil. The plant required comprises a power unit, decorticator (for removing the shell from the seed), disintegrator, the oil expeller and settling tanks; and such plant requires the produce of about 2,000 acres in full bearing in order that it may run economically.

Value of Oil and market prospects.

10. Owing to its rather higher content of elaeostearic glycerides the oil of *A. fordii* is usually of slightly greater value than that of *A. montana* as rather more thinner can be used with the former in the preparation of varsish. Both oils are entirely suitable for use in paint and varnish manufacture, the only real difference being that a little more *montana* oil is required to make a gallon of varnish. (8). The slightly lower value of *montana* oil is more than offset by the higher yields obtained from this species under semi-tropical conditions.

11. The question of the relative value of the two oils is, however, liable to be complicated by the nature of the British Standard Specification at present in force, and as this might lead to confusion in discussions on Rhodesian tung prospects, it is advisable briefly to explain the present situation. The existing British Standard Specification No. 391-1936 for tung oil type F. was designed for *fordii* oil and *montana* oil will not conform to all the tests. There might therefore be a tendency for buyers to use this non-conformity in order to discriminate unduly against *montana* in the matter of price, although this has not occurred in recent years when tung oil has been scarce. During the war an emergency specification for *montana* oil was introduced, and I understand that a British Standard Specification for this type of tung oil will shortly be established, which should remove the possible difficulties mentioned above. Samples of Nyasaland *montana* oil recently sent to the United Kingdom have been pronounced satisfactory and readily saleable.

12. The demand for tung oil has for some time been in excess of supply and prices have been high. The 1946 Nyasaland crop was sold at a price of £235 per ton f.o.b. Beira and until a few months ago the London price had remained steady at £275. China is, and always has been, by far the largest producer of tung oil and it was expected that as soon as supplies from that country became more plentiful after the cessation of hostilities then the price of the oil would fall. This has now happened, and the latest information available indicates that the price in the near future is likely to be in the neighbourhood of £150 per ton both in South Africa and in the United Kingdom. As far as one can see at present there is not likely to be any difficulty in selling tung oil for some time to come and I think it unlikely that the price will fall below £100 per ton. It must be noted, however, that the crop, which was formerly only grown in China, is now being cultivated on an increasing scale in many parts of the world, including the United States, several South American countries, the Dutch East Indies, India, Burma, Nyasaland and South Africa, and it is therefore only to be expected that some competition will be encountered in the future. In spite of this, the production of the oil within the Empire is still only a minute fraction of the consumption of the United Kingdom and there is room for considerable expansion of tung cultivation before the Empire can become self sufficient as regards its requirements of the oil.

Cost of Production and returns.

13. It is impossible for me to give an estimate of the probable cost of production of tung oil in Rhodesia as I am not acquainted with local land prices or rents, labourers' wages and daily output, costs of mechanical cultivation, building, etc., etc. Nyasaland costs are based on the assumption that all the field work is done by hand labour, which is almost invariably the case. I think that cultivation costs could be considerably reduced by the use of mechanical cultivation, and it is certain that the initial clearing costs would be much lower in Rhodesia where most of the land is either under grass or only sparsely wooded.

TUNG PLANTATIONS VISITED IN RHODESIA.

14. In the short time at my disposal I was only able to see seven of the small tung plantations or plots which have been established in Rhodesia. I do not know the total number or extent of the tung plantations in the Colony but from what I have been told the total acreage is small and those I have seen form a fair sample of the results obtained.

A. fordii.

15. On a farm about 10 miles west of Marandellas there is about 40 acres of *A. fordii* growing on poor sandy soil under an average rainfall of 30 to 35 inches per annum and at an altitude of just over 5,000 feet. Owing to the absence of the owner during the war the trees received little or no cultivation after the first two years. Growth is rather poor, although considering the adverse effects of poor soil, low rainfall and lack of cultivation the trees have done better than I would have expected. Another *fordii* plantation aged 5 or 6 years, near Rusapi, on similar soil under a rainfall of 30 inches and at 4,700 feet, which had also received little cultivation, was exceedingly poor. On a farm in the Eastern Districts, there are thirty *fordii* trees over ten years old which evidently grew well in their early years but have long been entirely neglected and are now in very poor condition. Here the soil is good and rainfall much higher (see para. 20). Better results have been obtained with *fordii* on two farms in the Grass-flats area, south of Chipinga. At one the oldest trees are at least 12 years old and in spite of having received practically no cultivation they had made reasonably good growth. On the other farm the trees are 7 years old and have also grown quite well. At both places the soil is a light red sandy loam, apparently of good depth, the elevation about 4,000 feet and the rainfall, according to the map, is over 40 inches. No yield records are available from any of the above trees.

A. montana.

16. One farmer also has nine *A. montana* trees three years old which have made excellent growth but have not yet begun to bear fruit. Another plot of *A. montana*, 18 months old, has been planted at Zona Tea Estate (elevation 3,000 feet, rainfall about 50 inches) and has made quite fair growth in spite of being sited on rather poor soil and of the drought experienced this year.

17. By far the most interesting trees which I saw were those at the Umtali Experimental Station. Both species are grown but the growth and yields of *A. fordii* have been found to be markedly inferior to those of *montana* and I therefore confine my remarks to the latter. With the exception of a small plot of buddings two years old, and of a certain number of supplies, all the trees were planted in 1939. In these older plantations there is a small number of male trees which have been top-worked by budding on the main branches and a few budded supplies, but the remainder of the trees are seedlings and there is therefore a large proportion of males. In the top part of the plot up on the hillside, where the trees are much exposed to strong winds growth is poor, but in the lower, more sheltered portion of this plot, and

in the other two plots, growth is well up to Nyasaland standards and fruiting of the bearing trees appeared to be normal. On none of these plots could the soil be called rich and in the largest plot it is definitely poor. Intercropping was practised in two of the plots but of recent years they have been put down to grass and cattle grazed under the trees. The hillside plot has never received any cultivation beyond slashing the grass. I am informed that the average rainfall is only 35 inches. The seedling trees have shown clearly that *A. montana* will grow well and fruit normally at Umtali, even on rather poor soil.

18. *Aleurites fordii* was the first species of tung tree to be planted in almost all territories in the Empire and in general it gave disappointing results, which in many places led to the abandonment of, or to considerable delay in, efforts to develop tung growing. In some countries *A. montana* seedlings were subsequently planted and gave much more promising results, but the greatly increased yields which can be obtained from budded *montana* plantations were either not realised at all or not explored until much later. This appears to have been the sequence of events experienced in Rhodesia. Most of the trials have been with the less satisfactory *fordii* and usually under unsatisfactory conditions of soil and rainfall. So far as I am aware the only real trial which has been made with *montana* is that at the Umtali Experimental Station where the results with seedlings have been very satisfactory.

AREAS VISITED IN THE EASTERN DISTRICT.

19. I only had time to travel by car around that part of the Eastern Districts to the South of Umtali which, according to the rainfall map, receives an average of 40 inches or more per annum. There was no time for more than brief stops and the area is a difficult one in which to assess the extent of tung possibilities owing to the great local variation in altitude, frost incidence, soils and rainfall. As regards rainfall, there were several places which were well within the 40 inch isohet on the map where local opinion put the average rainfall as considerably less. I was therefore only able to obtain a rough idea of tung possibilities and my impressions will best be given by brief notes on the journeys made.

20. **Umtali - Cashel - Melsetter.** From Umtali to Cashel the road passes through an area where the rainfall is too low for tung growing, but in the Umvumvumvu valley, between Mutumbara Mission and Cashel, it would be practicable if the rainfall were supplemented by irrigation, which I think could be easily and cheaply provided. South of Cashel I was much impressed with the large areas of land which would be suitable for tung in the neighbourhood of Umsana, Vooruitzicht, Welgelegen, Tilbury and Springfield, and, to a lesser extent, Taandai and Steyn Bank. In the valleys and on the lower slopes of the hills there are large stretches of good, deep, red soil at an elevation of 3,500 to 4,000 feet and with a rainfall of over 40 inches. According to the records at Springfield rainfall over the last three seasons has been: 1944-45, 63 inches; 1945-46, 72 inches; 1946-47 (an exception-

ally dry year), 47 inches. These figures indicate optimum rainfall for tung over at least part of the area. Moreover, a great deal of the land is on easy slopes and is either under grass or only sparsely wooded: this would make for economical production as initial clearing costs would be low and labour requirements and expenses could be minimised by extensive use of mechanical cultivation. Frost occurs over parts of the area but would not generally appear to be a limiting factor as citrus and mangoes are grown. I am informed that similar conditions of soil, rainfall and topography exist along the line from Melsetter to the junction of the Cashel road and the main Umtali-Birchenough road. Between Springfield and Melsetter the road passes through country which is generally too high for tung and where the soil appeared to be much poorer.

21. **Melsetter - Chipinga - Mount Selinda.** After leaving Melsetter the land near the road remains too high (5,000 feet or more) until the descent to approximately 3,600 feet about 8 or 9 miles before reaching Chipinga. From this point on, through Chipinga and southwards almost as far as Mount Selinda the elevation does not generally exceed 4,000 feet and I am informed that the greater part of the whole area is relatively free from frost. Rainfall, according to the map, is over 40 inches until one approaches the escarpment above the Sabie Valley, but I imagine that in some parts it might be rather less. The soils naturally vary, but there are large areas of light red, sandy loams of fair fertility which should be quite satisfactory for tung. The yellow-grey sandy soils, which are much in evidence as one approaches Mount Selinda, would probably not be satisfactory. The whole district is, one of gently undulating topography and is only sparsely wooded. Excellent conditions for tung also exist on the border near Zona Tea Estate, where much of the soil is fertile, deep, red loam, the elevation about 3,000 feet, and the rainfall presumably not much different from the average of 54 inches recorded at Mount Selinda.

22. **Umzila - Rattles Hoek - Chipinga.** The whole area between Umzila and Rattles Hoek lies within the 40 inch isohet on the map but at Stirling I was told that the average is only 32 inches and may therefore be appreciable local variations. There is also considerable variation in soils, much of the land being of poor quality, but there is, nevertheless, a good deal of reasonably fertile red soil, especially in the neighbourhood of Rattles Hoek, and the elevation is usually below 4,000 feet. Good possibilities for tung growing undoubtedly exist.

23. **Umtali to Firwood, Highlands, Hoboken, Fangudu.** Rainrall here is over 40 inches and increases to 60 or 70 inches on the border., Tung could be grown, but probably only on rather a limited scale as much of the land is too steep, too high or too poor and rocky, and suitable sites for plantations would mainly be found on the red soils in the valleys. I imagine, however, that it would be more profitable to grow vegetables and potatoes on these soils in view of the nearby Umtali market.

CONCLUSIONS.

24. Tung does not seem to have been given a fair trial in Rhodesia because almost all the plantations have been with *A. fordii*, often planted under unsatisfactory conditions of soil and rainfall and given very little cultivation. Disappointing results have naturally been obtained from these trees. On the other hand *A. montana* has grown well and fruits normally at Umtali, where the soil is certainly not rich, the average rainfall only 35-40 inches and no very intensive cultivation has been given. It is clear that there are other parts of the Eastern Districts with large stretches of fertile soil and an appreciably higher rainfall where *A. montana* might be expected to do better than at Umtali. It was naturally impossible for me to make any estimate of the acreage of suitable land, and to give any figure would merely be making a guess, but there are certainly considerable areas which would be suitable. I was particularly impressed with the prospects for tung growing in the districts mentioned in paras. 20, 21 and 22 above, where there is a combination of good soil, rainfall of over 40 inches, gentle slopes and absence of thick woodland or forest. Under such conditions clearing and cultivation should be relatively cheap and good yields should be obtained provided that good clones of buddings are planted.

25. The majority of the small number of farmers with whom I spoke were in no way enthusiastic about planting tung. This is only to be expected as they have seen *A. fordii* grown with disappointing results and they have been given little or no information about the superior possibilities of *montana*. They are also aware that the few farmers who have produced a crop of *fordii* seed have only been able to sell it at relatively low prices after paying freight on it to South Africa or Nyasaland. In spite of this several farmers expressed willingness to make small trials with *montana*.

STEPS TO BE TAKEN IF IT IS DESIRED TO PROCEED WITH TUNG DEVELOPMENT.

26. If it is desired further to explore or to develop the possibilities which exist for tung growing in the Eastern District, then I think that the following steps should be taken.

27. There must be a more detailed examination of the district to study local variations in rainfall, soil, frost incidence, etc., in order that the area of suitable land may be roughly assessed and mapped. This survey should be undertaken by one or more officers who can combine local knowledge with some knowledge of tung growing and of soils. No doubt a good deal of information on soils and rainfall is already available.

28. It may well be suggested that before any commercial planting is undertaken the Department of Agriculture should establish trial plots at various places in the Eastern District in order to prove that the trees will indeed grow satisfactorily. This would require at least 4 or 5 years. Personally, I should be quite satisfied, without further trial, that they would grow satisfactorily on the good red soils at elevations between 3,000 and 4,000 feet where the rainfall is not less than 40 inches and frost

absent or slight, but trials might be desirable in other areas. The necessity for trial plots in the suitable areas will depend upon the reaction of the farmers to proposals to develop tung growing: if they are prepared to go ahead on a fair scale without further delay they may, in my opinion, be encouraged to do so without fear of the trees failing; if not, then trial plots may be necessary in order to demonstrate that the crop will grow satisfactorily.

29. It is absolutely essential that one or more officers with some knowledge and experience of tung growing be made available to take charge of tung development and to advise farmers. Nyasaland, although it still has a great deal to learn about tung, has made more progress both with commercial planting and with experimental work than any other country in the Empire, and the inter-territorial policy is one of closer co-operation between the Rhodesias and Nyasaland. It should therefore be easy to arrange for the interchange of information and of visits by officers between the two territories, or even, if necessary, for the establishment of a joint organisation for tung development and research. If it is decided to proceed with tung development in Rhodesia it would certainly be desirable for a qualified horticulturist from Rhodesia to visit Nyasaland and study tung cultivation there. It would probably also be advantageous for me to make a longer visit to Rhodesia.

30. An equally essential point is that the farmers should be provided with the best planting material available. If the Umtali yield records are reasonably accurate then there are several good trees there which are worth propagating, and there is already a small number of buddings in the nursery which are presumably derived from the best of the older trees. This, however, is only a very small beginning, and in view of the time required for a proper programme of selection, vegetative propagation and clone testing (see para. 5 above) it would clearly be desirable to obtain budwood of the most promising Nyasaland clones. The provision of good planting material for farmers who wish to grow tung on a small scale (50 acres or so) would probably best be done by the Department of Agriculture which would establish budwood multiplication nurseries and raise budded plants for issue to the farmers. On the other hand, a company wishing to plant tung on a big scale would probably find it advantageous to do its own nursery work. Quite apart from the initial provision of good planting material, any development of tung planting should certainly be accompanied by experimental work on the crop, particularly as regards the testing of various clones of buddings in order to determine which are the best under local conditions.

31. Steps would have to be taken to provide for the extraction and marketing of the oil. When production reached a level of 500—600 tons per annum the operation of a factory in the Eastern Districts would be a profitable undertaking, but in the early years the crop would be insufficient for the economic running of a factory. Growers might then find themselves in the present position of the few *fordii* growers who have to pay heavy freight charges on sending their crops to South Africa or Nyasaland and consequently make little profit. Provision must therefore be

made for the extraction of the oil in Rhodesia in the early years when production would not be big enough to make a factory pay. This might be done in one of the following ways:—

(1) Arrangements might be made with one of the existing oil expelling factories in Rhodesia to expel tung oil (instead of groundnut oil) for a short period each year.

(2) Government, having obtained a guarantee that a certain acreage would be grown, might erect and operate a factory in the early years and dispose of it later to a growers' co-operative.

(3) If any company wished to go in for tung growing on a big scale they might be prepared to erect a factory even before production was sufficient for its economic running.

This is what happened in Nyasaland.

32. The desirability of properly organised marketing and the export of a standard product needs no discussion. The arrangements made in Nyasaland may be seen by reference to the Tung Ordinance (1946).

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(7) Webster, C. C., "Improved Planting Material of the tung tree." E. African Agric. J. **11,** 165, Jan. 1946.

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EDITORIAL NOTE.

Attention is drawn to Bulletin No. 1408 on Tung Nut Growing by C. N. Hayter, Government Horticulturist, where it is stated that a rainfall of 30 inches and upwards is suitable for the crop under Rhodesian conditions, and that a free issue of one pound of seed is available for any Southern Rhodesian applicant wishing to try it out.

Negotiations are understood to be proceeding now, to obtain facilities for expressing Tung Oil in the Colony.

Report of Branch of Botany and Plant Pathology for the year ending 31st December, 1947

Staff: The following appointments were made:—

Miss J. Springett-Tapson as Technical Assistant on April 1st.

Miss J. Broadfoot, B.Sc., as Assistant Plant Pathologist on 17th November, and Miss M. A. Morgan, B.Sc., as Assistant Seed Analyst on December 1st. Mr. S. C. Seagrief was employed for one month as an Assistant in Plant Pathology during the University vacation in January.

Movements: Farms were visited in the following 23 areas:— Arcturus, Banket, Bindura, Bulawayo, Chipinga, Concession, Enterprise, Gatooma, Headlands, Inyanga, Inyazura, Karoe, Marandellas, Mazoe, Melsetter, Mt. Selinda, Odzi, Penhalonga, Que Que, Rusape, Salisbury, Umtali and Vumba.

The following Government Experimental Stations were visited in connection with botanical and plant pathological investigations:—Grasslands, Marandellas; Hillside Tobacco Station; the Henderson Research Station; the Forestry Reserve, Stapleford; the Sub-Tropical Experiment Station, Umtali.

Several journeys were made by Dr. Bates to Triangle Sugar Estates in connection with smut disease and tobacco warehouses in Salisbury were inspected from time to time to assess the diseases in the incoming crop.

Dr. Wild paid regular visits to the Makabuzi and Hunyani rivers to supervise the clearance of water hyacinth and spent some weeks on a survey of K34 farm at Karoe.

Dr. Bates spent two weeks in Natal in consultation with sugar specialists regarding smut control and also had discussions with research officers of the Union Department of Agriculture, particularly with regard to the "Kromnek" disease of tobacco.

Dahlias grown in quarantine from tubers imported from Holland were inspected in many parts of the Colony.

A botanical expedition spent two weeks at Mt. Selinda.

Meetings, Lectures, Shows, Etc. Four meetings of Farmers' Associations were attended. A series of lectures on applied botany and plant diseases at ex-servicemen's courses at Mt. Hampden, a tobacco demonstration at Hillside Station and a talk and demonstration to forestry students at the Forestry School, Mtao, were given.

An exhibit was staged in the Government pavilion at the Salisbury and Bulawayo Agricultural Shows; Dr. Hopkins and Dr. Bates acted as judges at the former.

Publications. In the *Rhodesia Agricultural Journal*:—

"The Eastern Districts Senecio Problem," by H. Wild. May-June.

"Farming Calendar," by the Staff. July-August, September-October.

"Seasonal Notes on Plant Diseases," by J. C. Hopkins and G. R. Bates. September-October.

In the *Rhodesian Farmer*:—

"The Uses of Botanic Gardens," by J. C. Hopkins, Vol. 1, Nos. 2, 4 and 6.

PLANT PATHOLOGY.

LABORATORY.

Four hundred and ninety-two specimens were received for examination and report, an increase of 40 over last year, of which 17 were newly recorded in the Colony. They were:—Root rot of beetroot (*Sclerotium rolfsii* Sacc.), bacterial wilt of *Amaranthus graecizans* Linn. (*Xanthomonas solanacearum* (Smith) (Dowson), wildfire of Turkish tobacco (*Pseudomonas tabaci* (W. & F.) Stapp.), fruit rot of apricot (*Botryodiplodia theobromae* Pat.), root rot of velvet bean (*Sclerotium rolfsii* Sacc.), fruit rot of egg plant (*Phytophthora parasitica* Dast.), rust of plum (*Puccinia pruni-spinosae* Pers.), leaf spot of Pelargonium (*Alternaria* sp.), leaf spot of Begonia (*Cercospora* sp.), fruit rot of avocado (*Phomopsis* sp.), algal spot of avocado (*Cephaleuros mycoidea* Karst.), storage rot of apple (*Stemphylium* sp.), wilt of sugar cane (*Cephalosporium sacchari* Butl.), mildew of Schizanthus (*Oidium* sp.), rust of *Rubus rigidus* Sm. var. *mundtii* (Cham. & Schlect.) C.E. Cost. (*Cronartium*, probably sp. nov.) fern leaf of tomato (*Cucumis* virus 1.), mosaic of tomato (*Nicotiana* virus 1.).

In addition, a considerable number of fungi have been isolated in pure culture and sent away for specialist determination, whilst a number of undetermined plant diseases are being investigated in the laboratory.

Most of the work of the laboratory has been directed to tobacco diseases, more especially *Alternaria* leaf spot (*A. longipes*). Bacterial wilt (*Xanthomonas solanacearum*) and anthracnose of seedlings, the causal fungus of which has not yet been determined, have also received attention.

A blemish which develops on Turkish tobacco leaf and goes under the name of "copper sickness" in Southern Rhodesia, was reported from the Karoe district. Several farms were visited and the disease investigated in the laboratory. It appears to be the same as that known as "verderame," or "green-spot," disease in Italy, the cause of which has not been ascertained with certainty. In the Middle East the condition is attributed to cultivation on over-fertile soil and it seems likely that this is the cause of the

disease in Rhodesia, but its development is also associated with climatic conditions. It was found in the samples tested at the laboratory that the blemish could be reduced by delayed harvesting or by "sweating" the leaf for several days before putting on to the curing racks. It was also shown that no infectious organism was associated with the disease. It was in many ways comparable with the well-known "secondary growth," which develops in mature Virginia tobacco after rain has fallen, seriously inhibiting the curing process.

An investigation was made of the reported phytotoxic effect of D.D.T. used as a soil insecticide in tobacco seed-beds. Experiments conducted at the laboratory demonstrated that under certain conditions the germination of tobacco seed may be delayed very seriously by contact with D.D.T.

Further studies were made of potato powdery mildew and its capability of infecting tobacco, under glass-house conditions, was confirmed. The fungus from potato did not, however, develop with the same virulance as the normal "white mould" of tobacco, and is presumably a different strain of *Erysiphe cichoracearum* D.C.

With recent staff increases it was found possible to comply with a recommendation of the Plant Regulatory Board advanced some time ago, that a closer study should be made of the so-called tobacco "Kromnek" virus (tomato spotted wilt) and its relation to the varieties of tobacco grown in Southern Rhodesia. Collections were made of dahlia plants showing ring or line patterns on the leaves and these were grown in the glasshouse in order to obtain mature tubers.

Under an arrangement made with Dr. A. P. D. McClean, of the Union Department of Agriculture, who is engaged on the "Kromnek" problem, infected material and seed of local varieties of tobacco were sent to him for test and experiments were in progress at the end of the year. It is proposed to take advantage of Dr. McClean's generous offer to send further material as required.

PLANT IMPORTATION.

Dahlias. A considerable number of dahlia tubers were imported from Holland during the year and grown under quarantine conditions. Inspections were made of the growing plants for the presence of the tomato spotted wilt-virus (Kromnek) and a certain number of suspects observed. These are being tested for the virus as reported above.

In view of these findings it was thought advisable by the Plant Regulatory Board to cease temporarily the issue of permits for the importation of dahlias from Holland, until the position could be clarified or until the Dutch authorities could issue certificates of freedom from the virus based upon field inspection.

Seed Potatoes. A number of small consignments of seed potatoes were also imported from Holland. Samples grown at the laboratory showed most of them to be highly susceptible to

early blight (*Alternaria solani*) and therefore unlikely to be suitable for local cultivation. Some varieties also showed a very high proportion of plants infected with viruses of the severe mosaic type in the second-grown crop. Susceptibility to disease in all varieties grown was much higher than in Up-to-Date.

Complaints have been received from importers and growers about the grading of seed potatoes from Scotland and Ireland. Inspection showed much irregularity in size, and in the case of the latter a much higher proportion of surface diseases than is allowable for the "A" certificate, about 25 per cent. of the tubers being seriously infected by scab and/or *Rhizoctonia* sclerotia. The general condition was otherwise good and all tubers possessed vigorous sprouts.

Flowers. Anemones imported from Europe showed a high percentage of leaf chlorosis and vein-banding symptoms suggestive of virus infection, but no time was available for laboratory investigation.

CROPS.

The drought last season reduced to negligible proportions the distribution of normal plant diseases, but certain abnormalities were responsible for serious losses. This was particularly marked in the case of tobacco.

Tobacco. As a result of the prolonged dry periods between rain experienced in most parts of the Colony, tobacco stood in the lands for as much as seven weeks longer than is usual, making no upward growth and apparently very little advance to maturity. The leaf, however, although remaining green became susceptible to infection by frog-eye (*Cercospora nicotianae*), the disease progressing from below to many of the upper leaves where it appeared as reddish brown spots simulating *Alternaria* leaf spot. In many cases the lower leaves became severely diseased but little or no attempt was made by growers to remove this source of infection. As a consequence, by harvest time an intense incipient infection had been set up in all leaves by spores from the older leaf spots and very severe barn spot occurred during curing. Periodic inspection of the crop in the grading warehouses and auction floors indicated that this was general in most districts. Field spraying failed to control frog-eye under these conditions.

In recent years there has been a tendency for growers to be less punctilious in the precautions they take to eliminate mosaic, with the result that the proportion of diseased plants in many crops is much higher than it used to be. Under the drought conditions last year the necrotic type of mosaic, known as mosaic scorch, was widespread and must have been responsible for the loss of much leaf in the total crop.

Other types of necrotic spotting apparently due to viruses were common, but no case of severe injury was reported.

Following general infestation by aphids of the late plantings a mild epiphytotic of rosette in Virginia tobacco occurred at the end of the season. The disease, however, did not appear in severe

form in the Turkish crops as might have been expected and no serious infection of the 1947/48 Virginia crop has been reported to date. Aphids had appeared in some crops by the end of the year and some growers had commenced spraying with insecticides.

A somewhat disturbing feature of the crop in districts which received adequate rainfall was the apparently increased virulence of *Alternaria* leaf spot on tobacco grown on sand veld. This is probably due to the heavier type of leaf with a longer maturation period now being grown in these areas, which in the past normally produced a thin textured, quick ripening leaf, but the possibility of a more virulent strain of the fungus having arisen is being considered for future investigation.

Several diseases were recorded on the cigar tobacco being tested in the Chipinga area. Among these were wildfire, frog-eye, mosaic and anthracnose, the symptoms differing considerably from those on Virginia and Turkish varieties.

Maize. No diseases of note were recorded on this crop.

Sugar Cane. Smut (*Ustilago scitaminea*) continues to appear in the crop at Triangle Estates and several methods of control have been put into operation. A number of new varieties have been planted to test for resistance. Investigations into the disease as it occurs locally are continuing.

Potatoes. Early blight appeared unexpectedly on many crops during the drought period and in some cases cut down the plant prematurely. It was found necessary to spray early, before the disease appeared, in order to obtain satisfactory control.

Mildew was again reported from the same farm as last year. Control by sulphur dusting is being tested.

More cases of bacterial wilt (*Xanthomonas solanacearum*) occurred, but nowhere was it observed to be very extensive. One report was, however, received of the complete destruction of a crop on land which had previously produced a similar disease, which was not at the time identified. The outbreak is being investigated.

Fruit, Flowers and Vegetables. Peach mildew was reported again from new districts. It appeared in very severe form in Que Que and has also been seen in another part of the Inyanga district. It has not yet appeared in the Rhodes Estate orchards and now that the new spray pump has been received, a spray schedule is being introduced to protect the new trees.

The rust of wild blackberry found at Umtali appears to be a new species of *Cronartium* and collections of material have been sent away for expert determination. This disease may be of importance if the production of berry fruits is developed in the Eastern Districts.

Antirrhinum rust has appeared in severe form on some of the new tetraploid varieties grown in Salisbury.

The new bacterial blight of Zinnia has again been found occurring naturally in a garden bed planted to Zinnias two years ago.

Black rot of cabbage appeared in severe form during the period of hot dry weather. The symptoms were quite abnormal, simulating both virus infection and insect injury. The bacterium was, however, identified and the blackening of vascular tissues was marked, but only in the most advanced cases. The appearance of this disease under drought conditions is worthy of note.

Further records of bacterial wilt of tomato (*Xanthomomas solanacearum*) were obtained and a report received from an infected farm of what was apparently the same disease in egg plant. This is a new record for the Colony, but unfortunately no material was sent in.

Mosaic of tomato due to the tobacco mosaic virus was definitely identified for the first time. The necrotic marking of the fruits was a conspicuous feature of the disease.

RESEARCH.

Tobacco. Towards the end of the year Dr. Bates was seconded for research work on tobacco, more especially that being done in collaboration with Messrs. Pest Control (C.A.) Ltd. and subsidised by the Government and Rhodesia Tobacco Association. Attention was devoted mainly to the *Alternaria* disease to discover (a) the earliest stage of development of the tobacco plant at which it becomes susceptible to infection, (b) whether copper sprays alone could control the disease, (c) whether several strains of *A. longipes* with varying virulence existed, and if so, how they could be detected, and (d) whether the fungus was capable of establishing a dormant infection of young plants, which only developed at the approach of maturity.

As it was not possible for all these projects to be undertaken simultaneously by one plant pathologist, they were divided among other members of the staff, who worked together in collaboration. Thus a study of the disease is being made at all stages of the tobacco plant from seed to mature leaf.

Already it has been found that there is wide variation in the size and shape of *Alternaria* spores found on tobacco leaf spots and an analysis is being made by inoculation tests of the relationship of the various types to *Alternaria* leaf spot.

The study of possible dormant infection has so far yielded negative results, the fungus apparently differing on the leaf from its behaviour in artificial culture. Abnormal lesions have, however, been produced on young seedlings.

In an attempt to obtain a more intensive investigation of the spraying trials conducted in collaboration with Messrs. Pest Control (C.A.) Ltd., the experiments were confined to a few farms only in representative districts. Large numbers of leaf samples have been taken before and at various intervals after spraying to assess the adhesiveness and consequent protection provided of

a number of copper fungicides. Results obtained in collaboration with the Chief Chemist so far show that there is considerable variability in the spray materials used and explain some of the contradictions of last year's trials.

A series of experiments for the control of *Alternaria* leaf spot have been laid out on K34 farm at Karoe. These investigations include studies of the different stages of infection leading to an epidemic, the effects of potash and phosphate application on the incidence of the disease, the effects of fungicides applied at varying intervals of time and the reaction of a number of imported varieties of tobacco to *Alternaria*.

The investigation into bacterial wilt has been continued as far as time would allow and an experiment laid out on infected land to ascertain the susceptibility or resistance of a large number of rotation crops. Last year's drought made it impossible to test the Granville wilt-resistant tobacco obtained from U.S.A., but the seed has been taken over by the Tobacco Branch and is being bulked up.

The anthracnose spot of seedlings has caused alarm in certain districts as the fungus does not appear to be checked by normal copper sprays. Indications so far suggest that the disease is of minor importance only and does not develop on plants in the field.

The results obtained from the spraying trials conducted in collaboration with Messrs. Pest Control (C.A.) Ltd. during the 1946/47 season was disappointing. The drought depressed all the normal leaf spotting diseases and in most of the experiments little or no disease developed in sprayed or control blocks. Frog-eye was an exception, as reported above; spraying alone did not give satisfactory control. Nor was it expected to, as this Branch has consistently emphasised the importance of the removal of the bottom spotted leaves in order to obtain adequate control of the barn spotting stage of the disease. In two experiments where suitable priming was done in conjunction with spraying, frog-eye infection was notably depressed.

On two farms in the Umvukwes where satisfactory amounts of rain fell, a visible reduction in *Alternaria* leaf spot was obtained by spraying with cuprous oxide, thus enabling the growers to harvest ahead of the disease.

On one farm in the Sinoia area it was noted that spraying a large area had the effect of generally depressing *Alternaria* infection over the whole land, including the control block at one end. But the disease developed in very severe form in that part of the control block farthest away from the sprayed tobacco and the leaf was entirely destroyed in the most remote rows. Unsprayed tobacco of comparable age planted in a small land cleared in the bush some 300 yards from the other end of the sprayed land, was so severely attacked by *Alternaria* that no leaf was reaped.

Other indications of control of *Alternaria* leaf spot by copper fungicides were observed, but the drought so interfered with the experiments that no definite conclusions could be arrived at.

Angular spot appeared on one experimental farm only and it was completely eradicated by spraying with cuprous oxide.

Deciduous Fruit. Investigations were continued into diseases of apples and pears, particularly bitter rot (*Gloeosporium fructigenum=Glomerella cingulata*) and mildew (*Podosphaera leucotricha*).

A fruit rot of the yellow hawthorn hedge (*Pyracantha angustifolia* Schneid) was observed and two fungi obtained in pure culture from the same lesions on the diseased berries. One was a species of *Glomerella*, which consistently produced perithecia and no conidia in culture, the other a species of *Gloeosporium*, which consistently produced conidia but no perithecia in culture. When inoculated to apple, each set up a distinct type of rot differing from the other one and not identical with bitter rot as it commonly occurs in the Colony. It seems unlikely that three different fungi, all of the same genus, are concerned with a soft brown rot of apple fruits in Southern Rhodesia, and it is possible that they can all be referred to the very variable *Glomerella cingulata* and its coindial forms, but further cultural work is necessary to elucidate the position. It is important that the etiology of the very destructive bitter rot of apples and pears be known if a deciduous fruit industry is to be built up in the Colony.

For the control of bitter rot in the field, it is necessary to know the correct times for the application of a copper fungicide and a study was commenced of the etiology of the disease in the Rhodes Inyanga Estate orchards, where losses of as much as 50 per cent. of some varieties of fruit have been reported. Samples of apples and pears at different stages of development were collected and examined for dormant infection, but no evidence of this phenomenon was obtained. The date of the earliest appearance of bitter rot on a number of varieties of apples and pears has been obtained and preliminary spraying trials commenced.

A complication already encountered is that some of the most susceptible varieties are copper-sensitive and it is a question as to whether cultivation of these varieties should be continued.

The Rhodes Pear, although not copper-sensitive, is so very susceptible to bitter rot that its continued cultivation would appear to be a danger to the healthy apple and pear varieties now present.

Largely as a result of no winter wash having been applied for two seasons owing to the non-delivery of the new spray pump, mildew has become widespread on most of the apple trees. The more susceptible varieties, such as Rome Beauty, are so severely affected that growth has almost ceased. The full mildew spray schedule has now been commenced and some improvements over the control trees is noticeable, but it will take several years of good cultural conditions and intensive spraying to bring the disease under satisfactory control, if, indeed, it has not progressed so far as to make the process uneconomic.

To obtain satisfactory results from the use of fungicides it is essential that the trees be well fed and it would appear that the most pressing need at the moment is large quantities of compost or manure and the utilisation of the organic nitrogen in the lush undergrowth.

In conjunction with the fungicides programme experiments have been arranged in collaboration with the Horticulturist to investigate certain mineral deficiency diseases and to test the new hormone sprays to prevent friut drop, which is serious on some varieties.

Seed Potatoes. The cultivation of seed potatoes was continued on a small scale and rogueing of the plots was carried out at the request of the Chief Agriculturist.

The selections made for early blight resistance in 1946 were grown in a comparative trial with first-from-imported Up-to-Date by the Manager, Salisbury Experiment Station. The result was disappointing, for it appeared that most of the plants selected were bolters or wildings and that foliar symptoms of vigour and freedom from early blight were misleading as characters for selection. Greater success has been obtained in previous years by selecting for foliar type, tuber shape and yield per hill.

Sugar Cane. Investigations into smut disease have continued and tests are being made to control the disease by the removal of smut whips alone.

Laboratory studies on the longevity of smut spores under varying climatic and soil conditions are in progress.

A number of newly imported varieties of sugar cane have been planted at Triangle Estate to test their resistance to the disease.

SEED ANALYSIS.

Germination tests were carried out for commercial firms engaged in the cleaning and disinfection of tobacco seed and the usual tests for seed-borne diseases made for the Seed Maize Association.

In connection with the latter an assessment of germination tests done for several years past has been made and compared with the Seed Inspectors' reports. It is now becoming clear that the amount of diseased grain found in seed samples sent in by the Inspectors is a fair indication of the care exercised by individual growers in their methods of selection.

With the appointment of the Assistant Seed Analyst in December, a survey of agricultural seeds being offered for sale in the Colony was commenced, and another survey of uncertified seed maize was made. At the same time the fungi found during germination tests were studied.

It is already evident that the quality of seeds varies greatly, especially that of the grasses, some samples of which contained a very low proportion of viable seeds. On the other hand, inert

matter and weed seeds were not prevalent. *Paspalum* seeds were often parasitised by the honeydew stage of ergot.

Uncertified maize seed, on the whole, contained more "Diplodia" than certified seed, but some of the uncertified samples were equal to the best of the certified.

BOTANY.

Herbarium. 2,430 specimens were received for determination, which represents an increase of 600 over the accession in 1946 and indicates the progress being made in the study of the Rhodesian flora. The majority of the specimens received have been named and added to the Herbarium.

It is gratifying to note an increase in the number of regular collectors, especially those making ecological surveys for specific purposes, such as tsetse fly and pasture research and animal disease investigation.

Grateful acknowledgement is made of individual collections. Those of special interest include:—124 duplicates from the Pole Evans Central and South African Expedition 1938 and 50 duplicates collected by Fr. Gerstner, donated by the National Herbarium, Pretoria; 92 duplicates from the Bubi, Victoria Falls, Matopos and Sebungwe areas collected by Mr. R. W. J. Keay, of the Nigerian Forestry Service; 152 duplicates from the Eastern Districts of Southern Rhodesia donated by Dr. B. S. Fisher, of the Union Botanical Survey; 280 specimens collected by Mr. R. M. Hornby from Portuguese East Africa; 38 specimens of edible plants collected by Dr. A. A. Pimenta, Director of Public Health Laboratories, Lourenco Marques; 43 duplicates from P.E.A. donated by Snr. J. Gomez Pedro, of Centro de Investigaçao Cientifica Algodeira; 215 specimens from little known areas of Southern Rhodesia collected by Mr. Whellan, Government Entomologist, during tsetse fly investigations; 153 specimens from the Eastern Districts donated by Mr. N. C. Chase; 42 suspected poisonous plants collected by Mr. W. F. Collins in Marandellas district; 73 grasses from the Provincial Agriculturist, Department of Native Agriculture. In addition over 900 specimens were collected by the botanical staff.

Botanical Expedition. During October another botanical expedition, this time to Mt. Selinda, was organised and led by the Botanist, Dr. Wild. The party included the Assistant Botanist, Miss Sturgeon, Messrs. Rattray and Corby of the Pasture Research Branch, Dr. C. Arnold, late Director of the National Museum, Bulawayo, and Mr. N. C. Chase, of Umtali, who is a regular collector for the Herbarium. Unfortunately no Forest Officer could be spared this year owing to previous commitments.

Two weeks were spent collecting in the neighbourhood of Chirinda Forest in order to obtain material of plants recorded by the late C. M. F. Swynnerton, which are not represented in the Government Herbarium. All the original material was distributed to herbaria outside the Colony and much of it was destroyed during the war.

In view of the need for authentically named species from this area, especially in regard to tsetse fly ecology and pasture research, much valuable material was obtained. Some 400 species were collected, which included many not recorded before in Southern Rhodesia, or new to science, and a number of economic value.

Thanks are due to officials of the American Mission, who kindly placed living quarters at the disposal of the party and assisted in many other ways.

Botanic Gardens. Little progress has been made with the scheme for converting Alexandra Park into Botanic Gardens, but negotiations for the transfer of the land are still taking place between the Government and the City Council.

As a result of the delay, the preliminary clearing and surveying could not be commenced as anticipated, nor could work be started on establishing the collection of *Aloe* spp. kindly promised by Mr. H. B. Christian last year. It was hoped to have planted a representative number of species this year, which could be multiplied and propagated under the guidance of Mr. Christian, to duplicate as far as possible his famous collection at Ewanrigg.

Botanical Survey. Preliminary steps in the direction of a botanical survey of the Colony have been taken and a number of small surveys of particular areas made during the year. Plans have been made to continue these reconnaissance surveys until such time as staff is available for more intensive work.

One such survey of particular interest, that of the new Government demonstration farm No. K34 in the Karoe district, was completed in March and the report circulated to officers of the Division of Agriculture and Lands concerned with the development of the farm. This was complementary to soil and timber surveys carried out by the Chief Chemist and Conservator of Forests. Material of the plants collected has been sent overseas for examination and when confirmative determination have been received it will be possible to issue a more detailed report for the use of Pasture Research Officers and others interested.

Collaboration and Exchange.

(i.) **Royal Botanic Gardens, Kew.** The greater part of the duplicate material of plants collected on the Inyanga Expedition in 1946 were sent to Kew for authoritative determination and almost all of them have now been received back. It is reported as being the best set of material from the area possessed by the Kew Herbarium and contains an unusually high proportion of plants newly recorded in Southern Rhodesia or new to science. Some of these are of considerable importance, as they fill gaps in the known phytogeographical distribution of the genera and so help to complete the overall picture of the African flora.

(ii.) **Lunds Botanic Museum, Sweden.** Further contacts with this museum have been made by the dispatch of duplicates

of the Inyanga material through Kew for comparison with that collected by the Swedish Expedition to this Colony in 1930. Valuable information has already been obtained from this source.

(iii.) **Herbarium of the Jardin Botanique, Brussels.** Duplicate material from Southern Rhodesia has also been sent to this institution, whose staff have a wide knowledge of the Congo flora and tropical African botany.

(iv.) **Herbarium of the British Museum.** Specialists there are working on certain groups of plants such as Labiatae and Pteridophyta and have offered to handle Rhodesian aquatic plants, about which little is known. In this way our present knowledge of these plants will be much increased.

(v.) **National Herbarium, Pretoria.** All our duplicate material of *Acacia*, *Tephrosia* and *Amaranthaceae* have been sent to Pretoria for specialist attention and in exchange we have received a large collection of named Central African and Northern Transvaal plants.

ECONOMIC BOTANY.

Edible and Poisonous Plants. Fifty-two poisonous plants and a considerable number of other plants thought to be of economic value have been reported upon, many of them being edible fruits, especially of *Acacia* spp. Many grasses have also been identified for various agricultural officials.

Weed Eradication. Much attention has been given to the eradication of certain weeds.

Following the favourable results obtained by the Botanist in the use of D N O C against Upright Starbur in Matabeleland in 1946, supplies of this weed killer were sent to seven Soil Conservation Officers for trials against local infestation of the weed.

Reports of success are now being received.

The drought completely upset the ecological control experiments organised by the Director of Native Agriculture during the 1946/47 season and reports are awaited of observations made this season.

A summary of the conclusions reached after a two years study of *Senecio sceleratus* Schweick, in the Eastern Districts, was published in the *Rhodesia Agricultural Journal*, it having been established that the weed is highly poisonous to cattle. Control by direct attack was shown to be impracticable, but there was evidence to show that eradication could be accomplished by correct pasture management.

The position regarding Water Hyacinth eradication is not satisfactory owing to the absence of continuous European supervision of the Noxious Weeds Scouts who are working on the Makabuzi River. Reinfestation of certain sections has occurred, and although eradication by spraying with hormone weed killer

has proved highly successful, the work is not done thoroughly and small patches of growing plants are left behind, which rapidly increase and spread. Fifteen miles of the river have been sprayed twice, from above the Enkeldoorn Road bridge to the junction with the Hunyani River, but islands of living plants still remain. A European ranger is urgently required for the task of supervision.

The Prince Edward Dam now appears to be free from the weed and every effort should be made to prevent it infesting the Hunyani Poort Dam site.

A programme for large scale research on the eradication of gifblaar (*Dichapetalum cymosum* (Hook) Engl.) has been drawn up and arrangements made to carry out experiments in the Nyamandhlovu area in co-operation with the Pasture Research Branch.

Laboratory experiments have continued in an endeavour to find suitable host plants which will germinate the seed of *Striga gesnerioides* (Willd.) Vatke, which parasitises tobacco roots. So far no success has been obtained and a new technique has been adopted for experiments now in progress.

Following on successful experiments conducted last year on the eradication of Blueweed (*Euphorbia inaequilatera* Sond.) the Royal Salisbury Golf Club have had all their greens sprayed with D N O C with satisfactory results. As the weed is continually reintroduced from the fairways on the shoes of players, periodical treatment will be necessary for at least a few years to keep it under control.

GENERAL.

Thanks are due to the Directors and staffs of the Commonwealth Mycological Institute, the Royal Botanic Gardens, Kew, the British Museum, the Lurds Botanic Museum, the National Herbarium, Pretoria, and to Dr. A. P. D. McClean, Department of Agriculture, Pretoria, for advice and assistance.

Laboratory facilities were afforded to a number of visitors, including Mr. R. W. J. Keay, Dr. B. S. Fisher, Mr. H. B. Gilliland, Snr. J. Gomez Pedro, Mr. F. C. Greatrex, Mr. H. B. Christian, and Mr. R. M. Hornby.

The Chief Botanist and Plant Pathologist served on the Divisional Conservation Committee, the Seed Maize Association Executive, the Plant Regulatory Board and the Plant Disease Committee of the Rhodesia Tobacco Association. The Senior Plant Pathologist attended meetings of the Sugar Industry Board and acted as alternate for the Chief Botanist and Plant Pathologist.

The Botanist accompanied a party of Soil Conservation students from Witwatersrand University, conducted by Prof. John Phillips, on a visit to the Inyanga and Umtali District.

Sgd. J. C. F. HOPKINS,
Chief Botanist and Plant Pathologist.

Departmental Bulletins

Copies of these Bulletins may be obtained from the Editor, Box 387, Salisbury. They are issued to residents of Southern Rhodesia at a charge of 3d. per copy and at 6d. per copy outside the Colony.

N.B.—The date the article appeared in the Journal is indicated in abbreviated form before the number, e.g., 3/31 No. 815, means that Bulletin 815 appeared in the Journal for March, 1931.

AGRICULTURE AND CROPS.

3/31 No. 815. New Strains of Oats for Southern Rhodesia, by H. C. Arnold, Manager, Agricultural Experiment Station, Salisbury.

5/31. No. 822. Re-stacking of Maize rejected for Export on account of Excessive Moisture.

8/32. No 859. Twenty-one Years of Plant Introduction, by Major Mundy, Chief Division of Plant Industry.

2/33 No 878. A I V. Silage: Memorandum prepared and circulated by Imperial Bureau of Animal Nutrition.

11/35. No. 972. Notes on Witchweed, by S. D. Timson, M.C., Dip.Agric. (Wye), Assistant Agriculturist.

3/36. No. 982. Weeds: Control of Weeds on Footpaths and Tennis Courts, by S. D. Timson, M.C., Assistant Agriculturist.

6/36. No. 992. Annual Report of the Agriculturist for the year 1935, by D. E. McLoughlin, Agriculturist.

8/36. No. 997. Reward Wheat: Report on the Baking Properties and Chemical Analyses, by The Rhodesian Milling and Manufacturing Co., Ltd.

11/36. No. 1008. Witchweed, by S. D. Timson, M.C., Assistant Agriculturist.

2/37. No. 1016. Natural Protection from Soil Erosion, by S. D. Timson, M.C., Assistant Agriculturist.

4/37. No. 1022. Smut Diseases of Wheat in Southern Rhodesia, by G. M. Wickens, B.Sc. (Agric.), Ph.D., D.I.C., Plant Pathologist, Tobacco Research Station, Trelawney.

5/41. No. 1173 Agricultural Experiment Station, Salisbury: Annual Report of Experiments, Season 1939-40, by H. C. Arnold, Manager.

7/41. No. 1176. Costings of Farm Operations on the Witchweed Demonstration Farm, Auchendinny, Season 1939-40, by S. D. Timson, Asst. Agriculturist, and G. L. Black, Dip. Agric. (Durham), Manager.

11-12/42. No. 1221. A Description of the more common Rhodesian Wheat Varieties, by T. K. Sansom, B.Sc., Plant Breeder.

3-4/43. No. 1230. Costings of Farm Operations on the Witchweed Demonstration Farm, Auchendinny, Season 1941-42, by S. D. Timson, M.C., Agriculturist; G. L. Black, Dip. Agric. (Durham), Manager.

9-10/43. No. 1242. Pyrethrum, by H. C. Arnold, Manager, Agricultural Experiment Station.

5-6/44. No. 1265. Notes on Growing Sweet Potatoes, by the Agricultural Branch.

9-10/44. No. 1271. Pyrethrum Drying, by V. A. Beckly, M.C., M.A., A.I.C., and F. McNaughtan, B.Sc. (Hons.), Dept. of Agriculture, Kenya.

9-10/44. No. 1275. The Care of Lucerne Lands in Winter, by W. van der Merwe, Field Husbandry Research Officer, Vaal-Hartz Experiment Station.

1-2/45. No. 1285. Wheat—Varieties tested at the Plant Breeding Station, Salisbury, and Available for Distribution, by T. K. Sansom, B.Sc., Plant Breeder.

1-2/45. No. 1297. Sunn Hemp Fibre Production, by D. H. Fox, Fibre Supervisor, Department of Supply, Salisbury.

5-6/45. No. 1305. Wheat Production in Southern Rhodesia, by D. E. McLoughlin, Acting Chief Agriculturist, and T. K. Sansom, B.Sc., Plant Breeder.

7-8/45. No. 1310. Trap Cropping to Control Witchweed, by S. D. Timson, M.C., Agriculturist.

9-10/45. No. 1317. Wheat: Examination of the 1944 Southern Rhodesia Crop, by P. Fuller, Chemist, The Rhodesia Milling & Manufacturing Co., Ltd., Bulawayo.

11-12/45. No. 1332. Wheat: Varieties Tested at the Plant Breeding Station, Salisbury, by T. K. Sansom, B.Sc., Plant Breeder.

1-2/46. No. 1337. Green Manuring: When to Plough Down the Crop, by S. D. Timson, M.C., Agriculturist.

3-4/46. No. 1341. The Potato: Methods of Cultivation in Southern Rhodesia, by S. D. Timson, M.C., Agriculturist.

7-8/46. No. 1356. Wheat: An Examination of the 1945 S.R. Crop, by P. Fuller, Chemist, The Rhodesian Milling & Manufacturing Co., Ltd., Bulawayo.

3-4/47. No. 1387. Wheat: An Examination of the 1946 S.R. Crop, by P. Fuller, Chemist, The Rhodesian Milling & Manufacturing Co., Ltd., Bulawayo.

7-8/47. No. 1398. Garden Compost, by S. D. Timson, M.C., Agriculturist.

9-10/47. No. 1415. The Sunflower (*Helianthus annuus*), by S. D. Timson, M.C., Agriculturist.

9-10/47. No. 1416. Kraal Compost, by S. D. Timson, M.C., Agriculturist.

9-10/47. No. 1418. Bulletin for Cotton Growers, by G. S. Cameron, Cotton Research and Industry Board.

11-12/47. No. 1422. Alternate Green Manure Crops, by S. D. Timson, M.C., Agriculturist.

11-12/47. No. 1426. An Improved Implement for use in Compost Making, by J. D. Scott.

3-4/48. No. 1437. Soya Beans, by H. C. Arnold, Agricultural Experimental Station.

5-6/48. No. 1441. Mechanisation at Gwebi: the "Multiple Hitch," by F. P. Ersmond, Superintendent of the Govt. Farm, Gwebi.

ANNUAL REPORTS AND REPORTS ON CROP EXPERIMENTS.

7/27. No. 649. Annual Report of Experiments, 1925-26, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Manager.

4/28. No. 683. Annual Report of Experiments, 1926-27, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Station Manager.

7/29. No. 745. Salisbury Agricultural Experiment Station Annual Report, 1927-28, by H. C. Arnold.

7/30. No. 789. Agricultural Experiment Station, Salisbury. Annual Report of Experiments, 1928-29, by H. C. Arnold.

9/31. No. 830. Salisbury Agricultural Experiment Station, Annual Report, 1929-30, by H. C. Arnold, Manager.

10/32. No. 864. Annual Report, 1930-31: Agricultural Experiment Station, by H. C. Arnold, Station Manager.

6/33. No. 895. Salisbury Agricultural Experiment Station Annual Report, 1931-32, by H. C. Arnold, Manager.

3/34. No. 914. Gwelo Municipal Demonstration Station: Final Report, 1933, by S. D. Timson, M.C., Dip.Agric (Wye), Assistant Agriculturist.

9/35. No 965 Salisbury Agricultural Experiment Station Annual Report, 1933-34, by H. C. Arnold, Manager.

2/36. No. 976. Annual Report of the Agriculturist for the year 1934, by D. E. McLoughlin, Agriculturist.

6/36. No. 992. Annual Report of the Agriculturist for the year 1935, by D. E. McLoughlin, Agriculturist.

5/39. No. 1110. The Management and Utilisation of Natural Pastures, by H. C. Arnold, Manager, Salisbury Experiment Station.

4/40. No. 1149. Salisbury Agricultural Experiment Station: Agriculturist's Annual Report on Experiments, Season 1938-1939, by H. C. Arnold, Manager.

5/41. No. 1175. Agricultural Experiment Station, Salisbury: Annual Report of Experiments, Season 1939-40, by H. C. Arnold, Manager.

3-4/42. No. 1200. Witchweed Demonstration Farm. Costings, 1940-41, by S. D. Timson, M.C., Assistant Agriculturist, and G. L. Black, Manager.

5/42. No. 1204. Agricultural Experiment Station, Salisbury: Annual Report of Experiments, Season 1940-41, by H. C. Arnold, Manager.

7-8/43. No. 1237. Annual Report of Experiments, Season 1941/42, by H. C. Arnold, Manager, Agricultural Experiment Station.

7-8/44. No. 1268. Annual Report of Experiments, Season 1942/43, by H. C. Arnold, M.B.E., Manager, Agricultural Experiment Station, Salisbury.

3-4/45. No. 1301. Annual Report of Experiments, Season 1943/44, by H. C. Arnold, M.B.E., Manager, Agricultural Experiment Station, Salisbury.

9-10/45. No. 1319. Witchweed Demonstration Farm. Final Progress Report: December, 1944, by S. D. Timson, M.C., Agriculturist.

7-8/46. No. 1360. Annual Report of Agricultural Experiment Station, Salisbury, Season 1944-45, by H. C. Arnold, M.B.E., Manager, Agricultural Experiment Station, Salisbury.

11-12/46. No. 1378. Annual Report of the Chief Agriculturist, 1945, by D. E. McLoughlin, Chief Agriculturist.

7-8/47. No. 1399. Annual Report of Agricultural Experiment Station, Salisbury, Season 1945-46, by H. C. Arnold, M.B.E., Manager, Agricultural Experiment Station, Salisbury.

AGRICULTURAL BUILDINGS.

9-10/42. No. 1216. Grain Storage Bins, contributed by the Irrigation Dept.

5-6/45. No. 1306. The "Gundry" Tobacco Furnace, by B. G. Gundry, A.I.Mech.E.

11-12/45. No. 1326. Construction of Dipping Tanks, by B. G. Gundry, A.I.Mech.E., and Notes on their Management, by J. M. Sinclair, M.R.C.V.S., Chief Veterinary Surgeon.

1-2/46. No. 1334. Piggeries, by B. G. Gundry, A.I.Mech.E., and A. E. Romyn, Ph.D.

3-4/47. No. 1389. Reinforced Brick Grain Bins, by Grain Bag Shortage Committee.

FARM BUILDINGS.

1-2/48. No. 1432. Buildings for Virginia Type Flue-cured Tobacco, by B. G. Gundry, Agricultural Engineer in collaboration with D. D. Brown, Chief Tobacco Officer.

CHEMISTRY.

5/35. No. 954. Experiments on the Toxicity to Fowls of Arsenite of Soda and Poisoned Locusts, by J. K. Chorley, F.R.E.S., and R. McChlery, B.A., B.Sc.

4/38. No. 1065. Nitrification in Red Soil in the Salisbury Area, by A. P. Taylor, M.A., B.Sc., and B. S. Ellis, B.Sc., A.I.C., D.I.C., Agricultural Chemists.

5-6/47. No. 1396. A Guide to some Rhodesian Soils, by B. S. Ellis, B.Sc., D.I.C., A.I.C., Chemistry Branch, Department of Agriculture.

4-10/47. No. 1412. Analyses of Rhodesian Foodstuffs, by the Chemistry Branch.

3-4/48. No. 1439. Seasonal Growth and Changes in Chemical Composition of the Herbage on Marandellas Sandveld, by H. Weinmann, D.Sc., Pasture Research Chemist.

DAIRYING.

1/41. No. 1170. The Manufacture of Cheddar Cheese, by The Dairy Branch.

3-4/43. No. 1228. The Manufacture of Gouda Cheese, by The Dairy Branch

3-4/44. No. 1260. The Dairying Industry, by the Dairy Branch.

5-6/44. No. 1264. Southern Rhodesia Milk Recording Scheme.

11-12/44. No. 1280. A Talk on Dairying, by F B. and M. Morrisby, Sunnyside Farm, Gwelo.

7-8/45, 9-10/45. No. 1321 Dairy Tests and Calculations, by The Dairy Branch.

9-9/46 & 1-2/47. Nos. 1361 & 1380. The Boltt Dairy Boiler, by the Dairy Branch.

7-8/47. No. 1400. Modern Milking, by the Dairy Branch.

7-8/47. No. 1401. The Dairying Industry, by J. R. Corry, B.Sc., Agric., Chief Dairy Officer.

7-8/47. No. 1405. The Milking Shed, by the Dairy Branch.

3-4/48. No. 1438. Cheese Making in the Home, by the Dairy Branch.

Blue prints of drawings of a Farm Dairy and Cowsheds can be obtained from the Chief Dairy Officer.

ENTOMOLOGY.

12/24 No. 522 Notes on the Black Citrus Aphis, by C. B. Symes.

8/25. No. 548. Insect Pests of Cotton, by C. B. Symes.

9/25. No. 553. Observations on some injurious markings of Oranges, by C. B. Symes, Entomologist.

7/30. No. 790. Notes on the Control of Some of the More Important Insect Pests of Citrus in Southern Rhodesia, by W. J. Hall, Ph.D., B.Sc., Entomologist to the British South Africa Company in Southern Rhodesia.

5/33. No. 892. The Tsetse Fly Problem in Southern Rhodesia, by R. W. Jack, Chief Entomologist.

5/33. No. 893. Experiments with Tsetse Fly Traps against *Glossina morsitans* in Southern Rhodesia, by R. W. Jack, Chief Entomologist.

7/33. No. 897. The Report of the Chief Entomologist for the year ending 31st December, 1932, by Rupert W. Jack, F.E.S., Chief Entomologist.

8/33. No. 899. The Black Maize Beetle (*Heteronchus Licus Klug*), by C. B. Symes.

2/34. No. 911. Screw Worm. A Pest of Ranch Cattle in Southern Rhodesia, by A. Cuthbertson, Entomologist. Foreword by R. W. Jack, Chief Entomologist.

3/34. No. 913. Locusts: Instructions for dealing with Flying Swarms, by The Division of Entomology.

12/34. No. 938. The Destruction and Control of Locust Hoppers, by R. W. Jack, Chief Entomologist.

8/35. No. 962. The Report of the Chief Entomologist for Year ending 31st December, 1934, by R. W. Jack, Chief Entomologist.

5/36 No 986 Annual Report of the Division of Entomology for year ending 31st December, 1935, by Rupert W. Jack, Chief Entomologist.

7/37. No. 1037. Division of Entomology: Annual Report for year 1936, by R. W. Jack, Chief Entomologist.

2/38. No. 1059. A Poison Bait for Young Locust Hoppers.

9/38 No. 1082. The Life History of Root Gallworm or Root Knot Eelworm, by M. C. Mossop, M.Sc., Entomologist.

4/39. No. 1105. Fumigation with Hydrocyanic Acid Gas, by M. C. Mossop, M.Sc.

8/39. No. 1121. Report of the Division of Entomology for the year ending 31st December, 1938, by J. K. Chorley, Acting Chief Entomologist.

5/40. No. 1154. Host Plants of the Tobacco Aphis (*Myzus persicae*), by Chas. K. Brain, M.A., D.Sc.

8/40. No. 1160. The Tobacco Aphid, by Rupert W. Jack, Chief Entomologist.

9/40. No. 1161. Control of Maize Weevil (Calandra oryzae, L.), by M. C. Mossop, A.F.C., M.Sc., Entomologist.

7/41. No. 1177. Tsetse Fly Operations: Short Survey of the Operations by Districts, by J. K. Chorley, Entomologist. Extracted from the Annual Report of the Chief Entomologist.

10/41. No. 1184. Cultural Measures for Control of Root-Knot Eelworm, with Special Reference to Tobacco, by R. W. Jack, Chief Entomologist.

5-6/42. No. 1201. (a). The Skin Maggot Fly, by Alexander Cuthbertson, F.R.E.S., Entomologist.

3-5/42. No. 1205. Ticks Infesting Domestic Animals in Southern Rhodesia, by Rupert W. Jack, Chief Entomologist.

7-8/42 No. 1208. Tsetse Fly Operations: Short Survey of the Operations by Districts, for the year ending December, 1941, by J. K. Chorley, Entomologist.

3-4/43. No. 1227. Plant Pests from Abroad, by M. C. Mossop, M.Sc., Entomologist.

11-12/43. No. 1249. On the Activity of the Tsetse Glossina Pallidipes and other Tsetse during a 24 hour period, by W. L. Williams, B.Sc., Entomologist.

3-4/44. No. 1259. Damage to Sapwood of Hardwoods by Powder-Post Beetles, by the Divisions of Forestry and Entomology.

11-12/44. No. 1283. Tsetse Fly Operations, 1943, by J. K. Chorley, Acting Chief Entomologist.

1-2/45. No. 1288. Orthezia Bug, by E. C. G. Pinhey, B.Sc., Entomologist.

5-6/45. No. 1307. Conservation of Insect Control, by M. C. Mossop, M.Sc., Entomologist (Lecture delivered to Conservation Officers, Salisbury).

11-12/45. No. 1331. Tsetse Fly Operations: Short Survey of the Operations by Districts for the year ending December, 1944, by J. K. Chorley, Acting Chief Entomologist.

1-2/46. No. 1340. The Olive Bug, by E. C. G. Pinhey, B.Sc., Entomologist.

9-10/46. No. 1365. Compost and White Grubs in Tobacco Lands, by B. L. Mitchell, B.Sc., Entomologist.

11-12/46. No. 1373. White Grub Control in Tobacco Lands, by B. L. Mitchell, B.Sc., Entomologist.

11-12/46. No. 1377. Annual Report, Division of Entomology, 1945, by J. K. Chorley, Chief Entomologist.

3-4/47. No. 1388. The Sunn Hemp Beetles, by E. C. G. Pinhey, B.Sc., Entomologist.

4-10/47. No. 1419. Tsetse Fly Operations in Southern Rhodesia: Short Survey of the situation for the year ended December, 1946, by J. K. Chorley, Chief Entomologist.

3-4/48. No. 1436. The Use of Gammexane for the Control of White Grubs and Wire Worms in Tobacco Lands, by A. A. Moffet, Tobacco Research Station, Trelawney.

3-4/48. No. 1440. Control of Harvester Termites, by M. C. Mossop, M.Sc., Chief Entomologist.

5-6/48. No. 1445. Report of the Division of Entomology for the year ending 31st December, 1947, by M. C. Mossop, M.Sc., Acting Chief Entomologist.

FORESTRY.

11/29. No 763. The Utilisation of Wood, by T. L. Wilkinson, M.Sc., B.Sc.F.

4/30. No. 778. The Utilisation of Wood in Southern Rhodesia—Conversion and Disposal of Timber, by T. L. Wilkinson, M.Sc., B.Sc.F., District Forest Officer.

8/30. No. 791. The Utilisation of Wood in Southern Rhodesia: Fencing, by T. L. Wilkinson, M.Sc., B.Sc.F., District Forest Officer.

4/33. No. 888. The Vegetable Ivory Palm (*Hyphaene ventricosa*), by G. M. McGregor, B.Sc., District Forest Officer, Matabeleland.

12/35. No. 974. Summary of the Annual Report of the Division of Forestry for the year 1934, by E. J. Kelly-Edwards, M.A., Dip. For. (Oxon.), Chief Forest Officer.

3/37. No. 1018. Veld Fires. The Forest and Herbage Preservation Act, 1936, by E. J. Kelly Edwards, M.A., Dip. For. (Oxon.), Chief Forest Officer.

4/38. No. 1068. The Control of Veld Fires, by Division of Forestry.

7/38. No. 1076. Eighteenth Annual Report of the Division of Forestry for the year 1937, by E. J. Kelly Edwards, M.A., Dip. For. (Oxon.), Conservator of Forests.

1/40. No. 1138. Nineteenth Annual Report Division of Forestry for the year 1938, by E. J. Kelly Edwards, M.A., Dip. For. (Oxon.), Conservator of Forests.

9-10/42. No. 1210. Charcoal for Gas Producer Plants, by the Conservator of Forests in consultation with the Technical Sub-Committee on Producer Gas Plants.

3-4/44. No. 1259. Damage to Sapwood of Hardwoods by Powder-Post Beetles, by the Divisions of Forestry and Entomology.

7-8/44. No. 1269. Vermin and Notes on Methods of their Destruction, by the Vermin Conference Committee, assisted by E. Davison, Game Warden, Wankie Reserve.

11-12/44. No. 1281. Utilisation of Forests, by T. L. Wilkinson, M.Sc., B.Sc.F., Forest Officer, Matabeleland.

7-8/45. No. 1313. Forestry Notes for Conservation Officers. Part I. The Relation of Forests to General Conservation and to Conditions in Southern Rhodesia, by E. J. Kelly-Edwards, Conservator of Forests.

9-10/45. No. 1320. Forestry Notes for Conservation Officers. Part II. Uses of Indigenous Forests, Wind Breaks, General Tree Planting, by E J. Kelly-Edwards, Conservator of Forests

3-4/46. No 1346. Wind-breaks and Shelter Belts, by A. A. Pardy, B.Sc. (Forestry), Forestry Division.

9-10/46. No. 1368. Raising and Planting of Trees on the Farm, by E. J. Kelly Edwards. M.A., Dip. For. (Oxon), Conservator of Forests.

11-12/46. No. 1375. Timber Preservation—Butt Treatment, by R. H. Finlay.

1-2/47. No. 1381. Pitsawing, by E. J. Kelly Edwards, M.A., Dip. For. (Oxon.), Conservator of Forests.

1-2/47. No. 1382. The Pot Planting of Eucalypts, by Major G. R. Wake, Vigila, Umvukwes.

1-2/47. No. 1383. Summary of the Twenty-Sixth Annual Report of the Division of Forestry for the year 1945, by E. J. Kelly Edwards, M.A., Dip. For. (Oxon), Conservator of Forests.

3-4/47. No. 1391. Some Trees, Shrubs, Shrubby-Herbaceous Plants, Climbers and Water Plants suitable for the Colony, by J. W. Barnes.

1-2/48. No. 1433. Price List of Forest Tree Transplants, Ornamental Trees and Shrubs, Hedge Plants, Creepers and Seeds obtainable at Government Forest Nursery, Salisbury.

7-8/48. No. 1447. The Use of Timber in Fencing, by the Division of Forestry.

HORTICULTURE.

2/29. No. 725. Investigations into "Collar-Rot" Disease of Citrus, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A. (Trinidad)

11/31. No. 834. Celery Culture, by G. W. Marshall, Horticulturist.

2/33. No. 876. Notes on African Aloes (Parts 1-6), by H. Basil Christian, "Ewanrigg," Arcturus.

10/33. No. 905. Notes on African Aloes (Parts 7-10), by H. Basil Christian, "Ewanrigg," Arcturus.

7/35. No. 960. The Rhodesian Home Orchard, by G. W. Marshall, Horticulturist.

4/40. No. 1150. The Health of Seed Potatoes, degeneration due to virus diseases is the greatest source of loss. Journal of the Ministry of Agriculture, December, 1939.

1-2/44. No. 1255. The Commercial Culture of Cape Gooseberries, by R. G. Skipwith, Umtali.

9-10/45. No. 1322. Price List of Fruit and Ornamental Trees obtainable from Sub-Tropical Experiment Station, Umtali.

7-8/47. No. 1408. Tung Nut Growing, by C. N. Hayter, F.Inst. P.A. (S.A.), Government Horticulturist.

1-2/48. No. 1435. Fruit Growing Possibilities of the Eastern Districts of Southern Rhodesia, by C. N. Hayter, Government Horticulturist.

7-8/48. No. 1448. Report on a Preliminary Reconnaissance of the Possibility of Cultivation of Tung Oil Trees in the Eastern Districts of S. Rhodesia, by C. C. Webster, Senior Agricultural Officer, Tung Experimental Station, Nyasaland, made at the request of the S.R.G. Natural Resources Board and Edited by C. N. Hayter, Horticulturist.

IRRIGATION, WATER SUPPLIES AND SOIL EROSION.

6/35. No. 956. Annual Report of the Division of Irrigation for the year ended 31st December, 1934, by P. H. Haviland, B.Sc. (Eng.), Acting Chief Irrigation Engineer.

1/39. No. 1095. Soil and Water Conservation, by D. Aylen, for the Irrigation Division.

7/39. No. 1117. Soil and Water Conservation. Part II. By D. Aylen and Irrigation Officers.

3-4/42. No. 1196. Gully Control: Some Recent Successes, by D. Aylen, Technical Assistant for Soil Conservation.

7-8/43. No. 1238. A Reinforced Concrete Roof for Circular Reservoirs, by H. W. H. Wallis, B.Sc., Assoc.M.Inst.C.E., Assistant Irrigation Engineer.

9-10/43. No. 1241. Stone Packed Weirs, by R. H. Roberts, B.Sc., A.M.Inst.C.E., Acting Director of Irrigation.

5-6/46. No. 1350. Annual Report of Irrigation Department for 1945.

5-6/46. No. 1352. Use of Brick Weirs in Control of Gullies, by E. S. White, Esq., "Bretton Farm."

7-8/46. No. 1358. Small Earthen Storage Dams, by the Irrigation Dept.

7-8/47. No. 1402. Annual Report of Irrigation Dept. for 1946, by the Director of Irrigation.

7-8/48. No. 1449. Irrigation, by K. J. Mackenzie, Senior Extension Officer.

LIVESTOCK.

12/33. No. 907. The Blackhead Persian: Its Breeding and Management in Matabeleland, by C. A. Murray, M.Sc., Lecturer in Animal Husbandry, Matopo Estate.

5/36. No. 987. The Curing of Hides and Skins on the Farm, by The Division of Animal Husbandry.

5/36. No. 988. Preparing Cattle for Show, by The Animal Husbandry Division.

1/37. No. 1012. Export of Frozen Porkers and Baconers. Fourth Consignment to Smithfield, by Division of Animal Husbandry.

4/37. No. 1023. Cowpea Molasses Silage for Fattening Steers, by C. A. Murray, M.Sc. (Agric.), Senior Animal Husbandry Officer in Charge, Matopo School of Agriculture and Experiment Station; A. E. Romyn, Ph.D., Chief Animal Husbandry Officer, Department of Agriculture, Salisbury; R. H. Fitt, Dipl. Agric., Animal Husbandry Officer, Department of Agriculture, Salisbury.

4/37. No. 1024. Comparative Feeding Value of Maize Meal and Nyouti (*Pennisetum typhoides*) Meal for Fattening Steers, by C. A. Murray, Senior Animal Husbandry Officer in Charge, Rhodes Matopo Estate; A E. Romyn, Chief Animal Husbandry Officer.

12/37. No. 1049. The Export of Frozen Porkers: Report on Five Consignments of Porkers Exported to Smithfield, by Division of Animal Husbandry.

11/38. No. 1091. Cost of Fattening Bullocks of various ages in Matabeleland, by A. E. Romyn and C. A. Murray.

7/39. No. 1120. Urea as a possible substitute for Peanut Cake for Wintering Young Stock, by C. A. Murray and A. E. Romyn.

1/40. No. 1140. The Summer Fattening of Bullocks, by the Division of Animal Husbandry.

2/40. No. 1143. Larger Calf Crops will increase your Profits, by C. A. Murray, Senior Animal Husbandry Officer in Charge, Government Experiment Station, Matopo.

3/40 No. 1147. A Home-made Cow Stanchion, by Major R. R. Sharp, Whinburn, Redbank.

3-4/42. No. 1198. Soft Fat in Bacon Pigs, by C. A. Murray, Division of Animal Husbandry.

3-4/45. No. 1299. Choice Beef, by the Division of Animal Husbandry.

11-12/45. No. 1327. Hand Rearing of Dairy Calves, by C. A. Murray and A. E. Romyn, Division of Animal Husbandry.

3-4/46. No. 1342. The Raising of Bacon Pigs, by A. E. Romyn, Chief Animal Husbandry Officer; C. A. Murray, Senior Animal Husbandry Officer, and a Veterinary Section by D. A. Lawrence, Director of Veterinary Research.

5-6/46. No. 1351. Feeding of Dairy Cows, by the Division of Animal Husbandry.

7-8/46. No. 1354. Winter Cereal Grazing for the Production of Fat Lambs—Press Service, Department of Agriculture, Pretoria.

7-8/46. No. 1355. Annual Report of the Chief Animal Husbandry Officer for 1945.

7-8/47. No. 1403. Sheep and Their Management in Southern Rhodesia, by C. A. Murray, Chief Animal Husbandry Officer.

11-12/47. No. 1428. Cattle Bale or Grip, by B. G. Gundry, Agricultural Engineer.

5-6/48. No. 1444. Care and Management of a Dairy Herd and the Making of Compost, by I. M. Krige, B.Sc. (Agric.), Animal Husbandry Officer, with Notes on the Making of Compost by S. D. Timson, M.C., Agriculturist.

METEOROLOGICAL.

12/24. No. 524. The Use of an Aneroid Barometer, by C. L. Robertson, B.Sc., A.M.I.C.E.

10/28. No. 712. The Time, and How to Find It, by N. P. Sellick, M.C., B.Sc. (Eng.).

2/33. No. 877. Clouds and Weather in Southern Rhodesia, by N. P. Sellick, M.C., B.Sc., Meteorologist.

PASTURES.

2/37. No. 1016. Natural Protection from Soil Erosion, by S. D. Timson, M.C., Assistant Agriculturist.

4/38. No. 1068. The Control of Veld Fires, by the Division of Forestry.

9/38. No. 1081. Uncontrolled Grass and Forest Fires and their Prevention, by the Rev. Father A. B. Burbridge, S.J.

9-10/46. No. 1366. Report on Tour of Pasture Research Stations in Union of South Africa, by J. M. Rattray, M.Sc., Pasture Research Officer.

9-10/46. No. 1367. Some Fundamental Aspects of Modern Pasture Management, by H. Weinmann, Dr. Agric., M.Sc., Pasture Research Chemist.

1-2/47. No. 1384. Prelim. Results in Improving the Sandveld Vleis on the Grassland Experiment Station, Marandellas, by J. M. Rattray, Pasture Research Officer, and R. H. Fitt, Animal Husbandry Officer.

7-8/47. No. 1409. Giant Rhodes Grass Pastures at Trelawney, by J. M. Rattray, M.Sc., Pasture Research Officer.

9-10/47. No. 1417. Thorn Bush Encroachment in Relation to the Management of Veld Grazing, by O. West, D.Sc., Pasture Research Officer.

11-12/47. No. 1425. The Grassland Problems in Southern Rhodesia, by William Davies, D.Sc., Director, Grassland Improvement Station, Stratford-on-Avon.

11-12/48. No. 1429. Umgusanne (*Dichapetalum cymosum*), by O. West, D.Sc., Pasture Research Officer.

3-4/48. No. 1439. Seasonal Growth and Changes in Chemical Composition of the Herbage on Marandellas Sandveld, by H. Weinman, D.Sc., Pasture Research Chemist.

5-6/48 & 7-8/48. No. 1446. Pasture Research in S. Rhodesia: Progress Report (1945-1947), by the Division of Pasture Research.

PLANT PATHOLOGY AND BOTANY.

PLANT PATHOLOGY.

2/29. No. 725. Investigation into "Collar-Rot" Disease of Citrus, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A. (Trinidad).

9/29. No. 754. "Pinking" of Maize: Report of a Preliminary Investigation, by T. K. Sansom, B.Sc., Plant Breeder.

11/30. No. 798. The Preparation of Bordeaux Mixture and Seasonal Notes on Tobacco Diseases, by J. C. F. Hopkins, B.Sc. (Lond.), A.I.C.T.A.

9/32. No. 861. Further Notes on Leaf Curl of Tobacco in Southern Rhodesia, by J. C. F. Hopkins, B.Sc. (Lond.), Plant Pathologist.

10/34. No 934. Mycological Notes. Seasonal Notes on Tobacco Diseases. 7, Spraying in Seed-beds and Lands, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

1/35. No. 942. Mycological Notes. Seasonal Notes on Tobacco Diseases. 8, The Mosaic Mystery. 9, Danger Points in Field Spraying, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

4/35. No. 951. Suspected "Streak" Disease of Maize. Notice to Growers, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

6/35. No. 957. Annual Report of the Branch of Plant Pathology for the year ending 31st December, 1934. by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

10/35. No. 969. The Objects and Value of Seed Treatment of Maize against Diplodia, by G. M. Wickens, Ph.D. (Lond.), D.I.C., Assistant Plant Pathologist.

4/37. No. 1022. Smut Diseases of Wheat in Southern Rhodesia, by G. M. Wickens, B.Sc., Agric., Ph.D., D.I.C., Tobacco Research Station, Trelawney.

6/38. No. 1074. A Note on a Stem Rot of Sweet Peas, by J. C. F. Hopkins, D.Sc., A.I.C.T.A., Senior Plant Pathologist.

8/39. No. 1122. Report of the Branch of Plant Pathology for the year ending 31st December, 1938, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

10/39. No. 1128. Mycological Notes. 12. The Diplodia Danger, by J. C. F. Hopkins, D.Sc., A.I.C.T.A., Senior Plant Pathologist.

12/39. No. 1134. Mycological Notes. 14. Seasonal Notes on Plant Diseases, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

8/41. No. 1180. Diseases of Fruit, Flowers and Vegetables in Southern Rhodesia: 3. Common Diseases of Snapdragons, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

12/41. No. 1188. Diseases of Fruit, Flowers and Vegetables in Southern Rhodesia: No. 5, Diseases of Potatoes, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

9-10/42. No. 1213. Diseases of Fruit, Flowers and Vegetables in Southern Rhodesia: No. 6. Virus Diseases of Cabbages and Cauliflowers, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., and Marie H. Pardy, B.Sc., Branch of Plant Pathology.

1-2/43. No. 1226. Mycological Notes. No. 16. The Campaign against Kromnek Virus, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

3-4/44. No. 1257. Diseases of Fruit, Flowers and Vegetables in S.R. No. 8, "The Yellows Disease of Cabbage," by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., and Marie H. Pardy, B.Sc.

9-10/45. No. 1314. The Ground Nut: Importance of Seed Disinfection, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

3-4/46. No. 1343. Tobacco: Alternaria (Brown) Leaf Spot of. by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

7-8/46. No. 1359. Annual Report of the Branch of Botany and Plant Pathology for 1945, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

7-8/48. No. 1450. Annual Report of the Branch of Botany and Plant Pathology for 1947, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Chief Botanist and Plant Pathologist.

BOTANY.

9/31. No. 826. Some Poisonous Plants of Southern Rhodesia, by Sydney M. Stent, Senior Botanist.

1/32. No. 841. Poisonous or Suspected Poisonous Plants of Southern Rhodesia: Tulip Poisoning of Cattle, by Sydney M. Stent, Senior Botanist, and D. A. Lawrence, B.V.Sc., Veterinary Research Officer.

2/33. No. 876. Notes on African Aloes (Parts 1-6), by H. Basil Christian, "Ewanrigg," Arcturus.

10/33. No. 905. Notes on African Aloes (Parts 7-10), by H. Basil Christian, "Ewanrigg," Arcturus.

3/39. No. 1102. Trees and Wild Flowers on the Rhodesian Farm. Part III. By Chas. K. Brain, M.A., D.Sc., Director of Agriculture.

4/39. No. 1106. Trees and Wild Flowers on the Rhodesian Farm. Part IV. By Chas. K. Brain, M.A., D.Sc., Director of Agriculture.

5/39. No. 1112. Trees and Wild Flowers on the Rhodesian Farm. Part V. By Chas. K. Brain, M.A., D.Sc., Director of Agriculture.

6/39. No. 1116. Trees and Wild Flowers on the Rhodesian Farm. Part VI. By Chas. K. Brain, M.A., D.Sc., Director of Agriculture.

7/39. No. 1119. Trees and Wild Flowers on the Rhodesian Farm. Part VII., by Chas. K. Brain, M.A., D.Sc., Director of Agriculture.

8/39. No. 1123. Trees and Wild Flowers on the Rhodesian Farm. Part VIII. By Chas. K. Brain, M.A., D.Sc., Director of Agriculture.

9/39. No. 1125. Trees and Wild Flowers on the Rhodesian Farm Part IX. By Chas. K. Brain, M.A., D.Sc., Director of Agriculture.

12/39. No. 1133. Trees and Wild Flowers on the Rhodesian Farm Part X. By Chas. K. Brain, M.A., D.Sc., Director of Agriculture.

1/40. No. 1139. Trees and Wild Flowers on the Rhodesian Farm. Part XI. By Chas. K. Brain, M.A., D.Sc., Director of Agriculture.

3/40. No 1146. Trees and Wild Flowers on the Rhodesian Farm. Part XII By Chas. K. Brain, M.A., D.Sc., Director of Agriculture.

1-2/45. No. 1284. Botanical Specimens for Identification—Correct Methods of Collecting and Despatching, by the Division of Botany and Plant Pathology.

11-12/46. No. 1379. Upright Star-Bur. A New Method of Control, by H. Wild, Ph.D., D.I.C., Division of Botany and Plant Pathology.

5-6/47. No. 1393. The Eastern Districts Senecio Problem, by H. Wild, Ph.D., D.I.C., Division of Botany and Plant Pathology.

5-6/48. No. 1443. A Suggestion for the Control of Tobacco Witchweed (*Striga gesnerioides* (Willd) Vatke) by Leguminous Trap-Crops, by H. Wild, Ph.D., D.I.C., Branch of Botany and Plant Pathology.

POULTRY.

3/27. No. 635. Ovarian Troubles, by A. Little, Poultry Expert.

1-2/45. No. 1289. Vicious Habits in Poultry, by The Poultry Branch.

7-8/45. No. 1312. Rearing and Fattening of Table Poultry, by H. G. Wheeldon, Chief Poultry Officer.

9-10/45. No. 1324. Trap Nests, by H. G. Wheeldon, Poultry Officer, and B. G. Gundry, A.I.Mech.E.

1-2/46. No. 1339. Modern Culling of Laying Hens, by G. H. Cooper, Assistant Poutry Officer.

9-10/46. No. 1370. Housing and Feeding Adult Poultry Stock, by H. G. Wheeldon, Poultry Officer.

11-12/46. No. 1376. Ducks on the Farm, by H. G. Wheeldon, Poultry Officer.

3-4/47. No. 1390. The Artificial Incubation, Brooding and Rearing of Chickens, by H. G. Wheeldon, Poultry Officer.

5-6/47. No. 1394. The Moult, by H. G. Wheeldon, Poultry Officer.

11-12/47. No. 1423. Control of Poultry Parasites, by A. A. Reed, Assistant Poultry Officer.

11-12/47. No. 1427. Feeding and Poultry Appliances for Poultry, by G. H. Cooper, Assistant Poultry Officer.

1-2/48. No. 1431. Breeding of Poultry for Economic Qualities, by A. A. Reed, Assistant Poultry Officer.

PAMPHLETS.

The following pamphlets can be obtained from the Poultry Officer upon application:—

Chicken-pox, by The Poultry Branch.

Coccidiosis, by The Poultry Branch.

Conditions of Birds on Show, by A. Little, Poultry Expert.

Diseases of the Liver, by The Poultry Branch.

Heart Trouble, by A. Little, Poultry Expert.

Grow Sunflowers, by The Poultry Branch.

Preparing Birds for Show, by The Poultry Branch.

Respiratory Disease of Poultry, by The Poultry Branch.

Visceral Gout of Fowls, by J. D. W. A. Coles, Veterinary Research Officer, Onderstepoort.

TOBACCO.

12/36. No. 1009. Tobacco Research on the Trelawney Station 1935-36 Season.

4/37. No. 1025. Report of the Tobacco Research Board, by Chas. K. Brain, M.A., D.Sc., Director of Agriculture and Chairman of the Tobacco Research Board.

3/38. No. 1063. A New and Serious Disease of Tobacco in Southern Rhodesia, by G. M. Wickens, Ph.D., D.I.C., Plant Pathologist, Tobacco Research Station, Trelawney.

6/38. No. 1072. Report of the Tobacco Research Board for the year ending 31st December, 1937, by Chas. K. Brain, M.A., D.Sc., Director of Agriculture, and Chairman of the Tobacco Research Board.

3-4/43. No. 1229. Use of Compost in the Manurial Treatment of Flue-cured Tobacco, by D. D. Brown, Chief Tobacco Officer.

7-8/46. No. 1353. Remote Indication of Temperature of Tobacco Barns, by F. G. Collins.

11-12/46. No. 1365. Compost and White Grubs in Tobacco Lands, by B. L. Mitchell, B.Sc., Entomologist.

9-10/46. No. 1369. The Culture of Virginia Type Tobacco in Southern Rhodesia: Field Operations, by D. D. Brown, Chief Tobacco Officer.

11-12/46. No. 1372. Preliminary Notes on Cigar Tobacco Culture, by D. D. Brown, Chief Tobacco Officer.

11-12/46. No. 1373. White Grub Control in Tobacco Lands, by B. L. Mitchell, B.Sc., Entomologist.

1-2/47. No. 1385. Tobacco Culture in Southern Rhodesia: Harvesting and Curing Virginia Type Tobacco, by D. D. Brown, Chief Tobacco Officer.

9-10/47. No. 1413. Electric Curing of Tobacco, by the Tobacco Research Board of Southern Rhodesia.

9-10/47. No. 1414. Tobacco Culture in Southern Rhodesia—Seed-beds, by D. D. Brown, Chief Tobacco Officer.

11-12/47. No. 1420. Dark Fire-cured Tobacco Culture in Southern Rhodesia, by D. D. Brown, Chief Tobacco Officer.

11-12/47. No. 1424. The Use of Compost for Flue-cured Tobacco. Part I. Field Trials, by A. A. Moffet, Tobacco Research Station, Trelawney.

1-2/48. No. 1432. Buildings for Virginia Type Flue-cured Tobacco, by B. G. Gundry, Agricultural Engineer, in collaboration with D. D. Brown, Chief Tobacco Officer.

3-4/48. No. 1436. The use of Gammexane for the Control of White Grubs and Wire Worms in Tobacco Lands, by A. A. Moffet, Tobacco Research Station, Trelawney.

5-6/48. No. 1443. A Suggestion for the Control of Tobacco Witchweed (*Striga gesnerioides* (Willd) Vatke) by Leguminous Trap-Crops, by H. Wild, Ph.D., D.I.C., Branch of Botany and Plant Pathology.

VETERINARY.

12/25. No. 570. The Spaying of Bovines, by G. C. Hooper Sharpe, M.C., M.R.C.V.S., and M. H. Kingcombe, M.R.C.V.S.

1/28. No. 666. Notes from the Veterinary Laboratory: Praemonitus—Praemunitus, by Ll. E. W. Bevan, M.R.C.V.S., Director of Veterinary Research.

4/31. No. 819. Measles in Swine, by P. D. Huston, M.R.C.V.S.

2/40. No. 1142. Low Birth-rate of Calves and Calf Mortality, by B. A. Myhill, M.R C.V.S., Chief Veterinary Surgeon.

8/41. No. 1179. Trypanosomiasis or Tsetse Fly Disease, by D. A. Lawrence, B.V.Sc., Director of Veterinary Research.

12/41. No. 1191. Laboratory Diagnosis of Disease: Preparation of Smears, by J. M. Williamson, B.Sc., M.R.C.V.S., Veterinary Research Department.

3-4/42. No. 1197. Laboratory Diagnosis of Disease. Part II. Submission of Specimens, by J. M. Williamson, B.Sc., M.R.C.V.S.

9-10/45. No. 1318. African Coast Fever, by Veterinary Department.

11-12/45. No. 1326. Construction of Dipping Tanks, by B. G. Gundry, A.I.MechE., and Notes on their Management, by J. M. Sinclair, M.R.C.V.S.

1-2/46. No. 1338. Internal Parasites in Sheep and Cattle, by Percy D. Huston, M.R.C.V.S., Chief Veterinary Surgeon.

3-4/46. No. 1342. Raising of Bacon Pigs, by A. E. Romyn, Chief Animal Husbandry Officer; C. A. Murray, Senior Animal Husbandry Officer, with a Veterinary Section by D. A. Lawrence, Director of Veterinary Research.

9-10/46. No. 1362. Carbon Tetrachloride for the Treatment of Liver Fluke and Hookworm, by D. A. Lawrence, B.V.Sc., Director of Veterinary Research.

9-10/46. No. 1364. Tick Transmission of Disease, by D. A. Lawrence, B.V.Sc., Director of Veterinary Research.

11-12/46. No. 1374. Sweating Sickness, by D. A. Lawrence, B.V.Sc., Director of Veterinary Research.

5-6/47. No. 1392. Quarter Evil, by D. A. Lawrence, B.V.Sc., Director of Veterinary Research.

5-6/47. No. 1397. Scheduled Diseases of Stock in Southern Rhodesia, by the Veterinary Department.

MISCELLANEOUS.

4/28. No. 686. The Land Bank, Its Functions and How it Operates, by S. Thornton.

4/28. No. 687. The Use of Explosives on the Farm, by P. H. Haviland, B.Sc. (Eng.).

5/31. No. 820. The Great Economic Problem in Agriculture—No. 1, by J. R. McLoughlin, M.Sc. (Economist), Economic Adviser.

9/38. No. 1081. Uncontrolled Grass and Forest Fires and their Prevention, by the Rev. Father A. B. Burbridge, S.J.

4/39. No. 1107. Some Notes on Game Bird Preservation, by W. E. Poles, Esq., on behalf of the Wild Life Protection Society of Southern Rhodesia.

6/39. No. 1114. The Rhodes Inyanga Estate.

7/39. No. 1118. Grass Fires and Fire-belt Burning, by J. R. Perrins, P.B.S. Ranch, Fort Rixon.

7-8/45. No. 1311. Report of Secretary, Department of Agriculture and Lands, 1944.

9-10/45. No. 1316. Post-war Land Settlement in Southern Rhodesia.

11-12/45. No. 1328. Baited Fly Traps, by Dr. D. M. Blair, Public Health Department, Salisbury.

11-12/45. No. 1330. Control of the Snail Hosts of the Bilharzia Parasites, by Dr. D. M. Blair, Public Health Department, Salisbury.

1-2/46. No. 1335. Brick-making on the Farm, by A. C. Jennings, Assoc. Mem. Inst. C.E.

3-4/46. No. 1344. Baited Fly Traps (Supplement), by Dr. D. M. Blair, Public Health Department, Salisbury.

3-4/46. No. 1347. How to make use of the Fencing Law and Preservation of Farm Beacons, by the Lands Department and L. M. McBean, Surveyor General.

7-8/46. No. 1357. Annual Report of Central Food Production Committee, 1945.

9-10/46. No. 1363. The Coverage of Tractor-Drawn Implements, by E. J. Waring, B.Sc.Agr., reprinted from Agricultural Journal, N.S.W.

11-12/46. No. 1371. Drying of Green Peas, by P. Wissing, Dehydration Officer.

3-4/47. No. 1386. Letting Machines do it; Farm Drainage Work Mechanised, by L. A. G. Barrett, Massey Agricultural College, New Zealand.

7-8/47. No. 1404. Annual Report of Secretary, Department of Agriculture and Lands, 1946.

7-8/47 }
9-10/47 } No. 1410. Farming Calendar, by Officers of the Department of Agriculture.

7-8/47 }
9-10/47 } No. 1411. Some Hints for Anglers on Fish Pests, by R. M. R. Stevenson, F.R.E.S.

11-12/47. No. 1421. A Start in Book-keeping, by S. M. Makings, Chief Agricultural Economist.

1-2/48. No. 1434. How to Instal a Simple and Efficient Hot Water Supply on a Farm, by W. A. Welch, Salisbury.

5-6/48. No. 1442. Farm Planning, by K. J. Mackenzie, Senior Extension Officer.

7-8/48. No. 1451. A Charcoal Safe or Cooler.

Programme and Progress Report of the Pasture Research Chemist

By H. WEINMANN, Dr.Agric., D.Sc., Pasture Research Chemist.

The Pasture Research Chemist works in close co-operation with the officers in charge of the two Central Pasture Stations. While some of his work has been indicated in the reports of these officers, others, more special, research projects of which the Pasture Research Chemist is in charge, are dealt with in this report in greater detail.

1. SOIL INVESTIGATIONS.

Survey of Marandellas Vlei Soils. A survey of Marandellas vlei soils, more particularly the experimental vlei areas, was undertaken during 1946/47. These vleis are typical of the sandveld vleis which are of so frequent occurrence in Mashonaland.* The sampling localities included wet vlei and dry semi-vlei. In the wet and moist vlei areas the surface soil, generally, consists of a layer of black soil of a depth of 4 to 5 inches overlying white sand; in the dry semi-vlei the surface soil is a blackish sand of similar depth. Soil samples were taken by means of a soil borer to a depth of 7½ inches. Determinations of the moisture content, maximum water retaining capacity, loss on ignition, organic carbon,** nitrogen, available phosphate, total exchangeable bases, exchangeable potash and lime, pH, and mechanical analyses (total sand, silt, clay and total colloids) were carried out.

Table I. gives the average figures for the three vlei types, the classification being based upon the water content of the soil at the time of sampling (12th June, 1946), viz. :—

1. Wet vlei, water content over 50% (means of 8 samples);
2. Moist vlei, water content 20 to 50% (means of 9 samples);
3. Dry semi-vlei, water content less than 20% (means of 8 samples).

Although there were considerable variations amongst the soil samples of one and the same group, most of the differences between the group means appear to be significant. The carbon and nitrogen contents are highest in the wet vlei and lowest in the dry semi-vlei, the values for the moist vlei being intermediate.

*J. M. Rattray and R. H. Fitt: "Preliminary results in improving the sandveld vleis on the Grassland Experimental Station, Marandellas." "Rhod. Agr. Jour." 44: 20-30. 1947.

**Determined by Walkley and Black's rapid titration method. (C. S. Piper, Soil and Plant Analysis. Interscience Publishers, Inc., New York. 1944.)

TABLE I.

Composition of Vlei Soils. Results expressed on the dry basis.

Vlei Type.	Water.	MWRC*	Total Sand.	Silt.	Clay.	Total Colloids.	Loss on Ignition.
	%	%	%	%	%	%	%
Wet Vlei	66.0	62.8	76.9	10.9	12.2	17.3	9.8
Moist Vlei	33.4	45.5	85.6	7.9	6.6	11.3	5.8
Dry Semi-vlei	7.9	38.9	90.0	5.2	4 8	7.2	3.1

	Carbon.	Nitrogen.	C/N Ratio.	Available P_2O_5	Total Exch. Bases.	Exch. K.	Exch. Ca.	pH.
	%	%		p.p.m.	m.e.%	m.e.%	m.e.%	
Wet Vlei	3.1	0.28	10.9	22.0	2.45	0.18	2.08	5.2
Moist Vlei	1.8	0.18	10.5	17.1	2.00	0.15	1.63	5.4
Dry Semi-vlei	1.0	0.09	11.8	12.8	1.30	0.09	0.95	5.5

The carbon/nitrogen ratio is more or less the same for the three groups. Maximum water retaining capacity and loss on ignition as well as total colloids, silt and clay show the same tendency as nitrogen and carbon, whereas the percentage of total sand is lowest in the wet vlei and highest in the dry semi-vlei.

As indicated by the pH values, the acidity is slightly higher in the wet vlei than in the moist vlei and dry semi-vlei, but these group differences are smaller than those between soils of one and the same group. Available phosphate, total exchangeable bases, and exchangeable potash and lime were determined on a selected number of samples. Though differences in these con-

*Maximum Water Retaining Capacity = grams of water retained by 100 grams of dry fine soil against gravity.

stituents are less pronounced than those for carbon and nitrogen, they nevertheless show the same tendency, i.e., an increase with the wetness of the vlei. The bulk of the total exchangeable base material consists of calcium together with smaller amounts of exchangeable potassium.

It may be concluded from these data that the potential fertility of vlei-lands of this type is higher in the moister than in the drier types of vlei. The former possess a larger percentage of organic matter than the latter, and though a certain proportion of this is merely undecomposed plant material, it may nevertheless be regarded as "potential humus," containing a certain amount of plant nutrients and adding advantageously to the general soil texture. The results support the claim that these soils might well be utilised in a better way than is generally being done at the present time. In this connection practical field experiments have been started at the Marandellas Grassland Experiment Station, with the aim of finding the best possible means of utilising such vlei areas.

Soil Survey of the Nyamandhlovu Pasture Sub-Station: A soil survey of this Station was initiated in 1947. A considerable number of representative soil samples have been taken and are being analysed at the present time. The results will be reported as soon as the work has been completed.

Effect of Indigenous Trees on the Nitrogen and Organic Matter Content of the Soil: The question whether indigenous trees (such as Msasa, Umnondo, and others) influence the fertility of the soil in natural tree-veld is important, since the stumping of such wooded areas is necessary to make the best use of them as pastures. For a preliminary investigation of this problem soil samples were taken from several old paddocks at the Marandellas Grassland Experiment Station. Two of these paddocks had been left unstumped and protected since 1930, and hence contained the original Msasa tree-veld vegetation, whereas the two adjoining paddocks had been stumped in 1930 and grazed since that time. In 1946 a number of soil samples were taken in four different places in each of these four paddocks. The sampling localities were chosen in representative areas, approximately five yards from the fence separating a stumped and unstumped paddock. For every sample taken in the stumped paddock a corresponding sample was taken in the adjoining unstumped paddock at a distance of about ten yards, so that a direct comparison of the two samples constituting one pair (stumped and unstumped) became possible.

The samples were taken to a depth of three inches, but the layer of undecomposed leaf mould was cleared away before digging up the soil in the unstumped paddocks. All visible undecomposed plant material (leaves, rootlets, etc.) was removed by hand from a portion of each soil sample before nitrogen, organic carbon, and loss on ignition were determined. The average results of these determinations are given in Table III.

TABLE III.

Comparison of Soils in Unstumped and Stumped Paddocks.

Percentages of the dry fine soil.

	Nitrogen	Organic Carbon	Loss on Ignition
Unstumped	0.058	0.71	3.15
Stumped	0.051	0.60	3.11
Difference	0.007	0.11	0.04
Standard Error of Difference	±0.005	±0.10	±0.19

The differences between the soils of the stumped and unstumped paddocks are very small and statistically insignificant. While it may be concluded that stumping did not affect the nitrogen and organic matter content of the surface soil to any measurable degree, it appears advisable to carry out further investigations before definite conclusions can be arrived at.

2. FERTILISER EXPERIMENTS.

Effect of Fertiliser Treatments on Established Vlei Pasture.

This experiment was laid out at the Marandellas Grassland Experiment Station in the 1946/47 season, and consists of 21 plots, 20 x 25 yards in area, receiving the following fertiliser treatments:—

1. O
2. Ca.
3. CaP.
4. CaN.
5. CaNP.
6. CaNPK.
7. 3x(CaNPK).

O = unfertilised.
Ca = 2,000 lb. agricultural lime per acre.
P = 200 lb. rock phosphate per acre.
N = 50 lb. ammonium nitrate per acre.
K = 50 lb. muriate of potash per acre.

The experiment was laid out in three replications, i.e., two replications in moist vlei, and one in semi-dry vlei. The plots were planted to upright Paspalum (*Paspalum urvillei*) in the summer of 1946/47. In the moist vlei portion the grass germinated well and made satisfactory growth during the 1946/47 season, but in the semi-dry vlei little germination took place before the rains of the 1947/48 season. No nitrogen or potash was applied in 1946-47, but in the moist vlei portion the grass showed a marked response to combined applications of lime and phosphate. In the

plots where no fertiliser or lime only had been applied growth was very poor and the grass of a yellowish colour. Since the beginning of the rains of the 1947/48 season the grass in the semi-dry vlei portions has made good growth as well, and differences between the various treatments are beginning to show. The grass was cut down on 17/18th December, 1947, and yield cuts were taken from the plots situated in the moist vlei. Table IV. gives the results of the yield and chemical determinations.

TABLE IV.

Yields and Chemical Composition of Upright Paspalum in Moist Vlei.

Treatment	O	Ca	CaP	3x(CaP)
Yields in lb. per acre.				
Fresh weight	968	1,150	4.075	4,870
Dry weight	232	325	1,006	1,108
Chemical Composition. Constituents as Percentages of the Dry Matter.				
Crude Protein	12.0	11.1	10.5	9.9
Acid-soluble Ash	4.1	4.1	5.3	5.6
Phosphoric Oxide	0.31	0.22	0.23	0.30
Potash	1.51	1.44	1.82	1.63
Lime	0.38	0.39	0.70	0.81
Nutrient Yields in lb. per acre.				
Crude Protein	27.8	36.0	105.6	109.5
Acid-soluble Ash	9.5	13.3	53.3	61.9
Phosphoric Oxide	0.7	0.7	2.3	3.3
Potash	3.5	4.7	18.3	18.0
Lime	0.9	1.3	7.0	9.0

The figures indicate that the use of phosphate combined with lime resulted in marked increases in the herbage yields, whereas treatment with lime only produced no great effect. (See also plates 1 and 2.) Differences in the chemical composition were generally small, except for the lime content, which approximately doubled by the combined application of lime and phosphate. The CaP and 3x(CaP) treatment greatly increased the yields of all nutrients (in lb. per acre). The experiment is being continued; fertilisers (including nitrogen

and potash) have been applied during the present season according to plan, and further yield cuts were taken. It is intended to expand this experiment in the next season by the inclusion of plots receiving phosphate without lime.

3. PRODUCTIVITY OF NATURAL SANDVELD PASTURES.

Seasonal Growth and Changes in Chemical Composition of Pasture Herbage on Marandellas Sandveld. Twenty-four quadrats, each 2 x 2 yards in size, were laid out in a typical sandveld pasture in the winter of 1946, and monthly cuts were taken from December, 1946, to May, 1947, representing six progressive stages of growth (four different quadrats being harvested every time). Yields and chemical composition of the grasses and other plants were separately determined.

As a detailed report on this work has been published,* it will suffice to summarise here merely the more important results. Dry matter yields increased up to the beginning of April for grasses, and up to March for other plants, after which time decreases in yields took place. The percentages of protein, acid-soluble ash, phosphoric oxide and potash decreased during the season, while the lime content showed only minor fluctuations. Crude fibre increased with the advance of the season. The yields of protein, acid-soluble ash, phosphorus and potash in the total herbage (in lb. per acre) increased with the advancement in growth stage, and reached maxima in early March; yields of lime were highest in the beginning of April. Considerable losses of nutrients were recorded towards the end of the season, and it is recommended that hay should be cut, if possible, not later than the beginning of March. Grasses were found to be inferior in protein and lime content to other plants, and the latter group contributed the greater portion of the yield of these constituents.

Separate samples were taken of ten individual species of grasses from December, 1946, to June, 1947. The results of the chemical analysis showed the same seasonal trends as were obtained for the composite herbage samples, though the individual species were found to differ in their chemical composition. Amongst the species of grasses investigated, couch grass (*Cynodon dactylon*) ranked highest as regards protein, phosphorus and lime content.

Growth and Chemical Composition of Pasture Herbage as Influenced by Different Cutting Treatments. This experiment consists of twenty quadrats (2 x 2 yards) situated in the same paddock as those discussed in the preceding section. These quadrats were subjected to four different cutting treatments, viz. :—

1. Cut once a season, i.e., in February.
2. Cut twice a season, i.e., in January and April.
3. Cut three times a season, i.e., in January, March and May.
4. Cut six times a season, i.e., at monthly intervals from December to May.

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*H. Weinmann: "Seasonal growth and changes in chemical composition of the herbage on Marandellas Sandveld." "Rhod. Agr. Jour." 45: 119-131. 1948.

There are five replications to each treatment. Grasses and other plants were separately harvested, and their dry matter yields and chemical composition determined. The data given in Table V. summarise the more important results for the 1946/47 season.

TABLE V.

Effect of Different Cutting Treatments on Yield and Chemical Composition of Herbage on Marandellas Sandveld.

Total Dry Matter Yields in lb. per Acre.

Cuts per Season.	Grasses.	Other Plants.	Total Herbage.
1	697	655	1,352
2	1,094	1,323	2,417
3	988	609	1,597
6	828	863	1,691

Average Chemical Composition. Percentage of the Dry Matter.

Cuts per Season.	Protein.	Acid-soluble Ash.	P_2O_5	K_2O	CaO
		Grasses.			
1	4.90	3.88	0.35	1.80	0.37
2	7.34	3.87	0.35	1.82	0.35
3	8.01	3.76	0.36	1.80	0.38
6	8.99	4.60	0.42	2.13	0.38
		Other Plants.			
1	8.26	4.76	0.32	1.79	1.03
2	10.93	4.69	0.36	1.64	0.89
3	12.66	5.12	0.43	1.80	0.95
6	15.14	5.32	0.63	2.08	0.73

Plate 1. Upright Paspalum in moist vlei at Marandellas.
In the foreground an unfertilised control plot, in the background a plot which has received agricultural lime and rock phosphate.

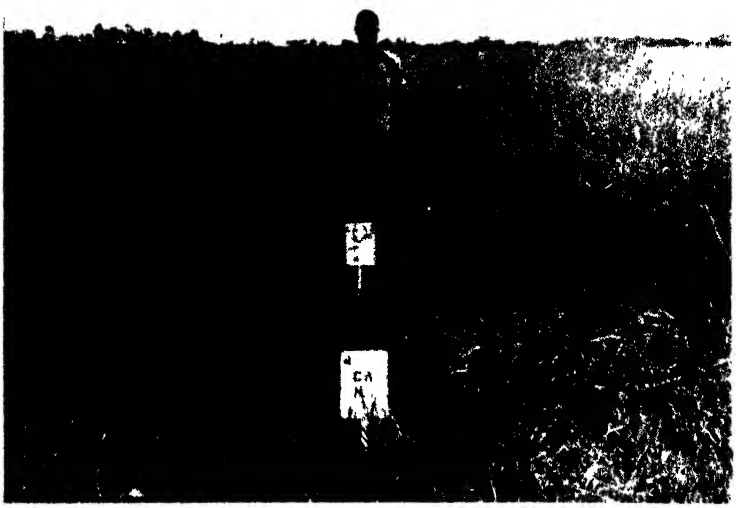

Plate 2. Upright Paspalum in moist vlei at Marandellas.
In the foreground a plot which has been treated with lime and nitrogen, in the background a plot which has received a complete fertiliser treatment of lime, nitrogen, phosphate and potash.

As will be seen, the highest herbage yields were obtained with two cuts per season (January and April). Frequent cutting markedly increased the protein content of the herbage, and to a lesser extent the percentages of acid-soluble ash, phosphorus and potash. It was, however, observed that the plants in the more frequently cut quadrats were lacking growth and vigour in the following season (1947-48). As in the preceding experiment, the grasses were found to be inferior in protein and lime content to the other plants constituting the vegetation of the pasture. The cutting treatments have been continued during the 1947/48 season, and it is intended to include studies on the root reserves and the recovery growth of the grasses.

4. PUBLICATIONS.

The following articles have been published by the Pasture Research Chemist:

H. Weinmann: "Some Fundamental Aspects of Modern Pasture Management." "Rhod. Agr. Jour." 43: 418.425. 1945.

———" Trace Elements for Better Pastures and Animal Health." "The Rhodesian Farmer," Vol. 1, No. 16. 1948.

——— "Seasonal Growth and Changes in Chemical Composition of the Herbage on Marandellas Sandveld." "Rhod. Agr. Jour." 45, 119-131, 1948. (Bulletin No. 1439 Dept. Agr. and Lands).

5. FUTURE WORK.

Some of the numerous pasture problems of practical importance which deserve attention, and the study of which should be undertaken in the course of time, are indicated, as follows:—

The feeding value of the herbage of the various veld types (sour, sweet and mixed veld) at different stages of growth and under different systems of veld utilisation and management.

The productivity and nutritive value of planted pasture grasses and legumes on dry land, vlei land, and under conditions of irrigation.

The effect of fertiliser and manurial treatments on the productivity and the feeding value of natural and established pastures under the various conditions pertaining in different parts of the Colony.

The ecological role of indigenous leguminous trees, shrubs and herbs, particularly their relations to the maintenance of soil fertility.

The role of temporary grass leys in agricultural rotations, more particularly their effects on soil structure and fertility.

Studies on plant poisons (e.g., hydrocyanic acid poisoning by certain grasses).

Vitamin studies and digestibility trials on important forage plants.

Programme and Progress Report of the Central Veld and Pasture Station for Matabeleland, to December, 31st, 1947

By OLIVER WEST, D.Sc. (Rand).
Pasture Research Officer.

INTRODUCTION.

The Central Veld and Pasture Station for Matabeleland was established during the latter half of 1945. The Station is located on the Rhodes Matopo Estate which lies approximately 20 miles south of Bulawayo at an altitude of about 4,500 feet and in the 20 to 25 inch rainfall belt. The climate is definitely semi-arid with a summer rainfall and a dry season lasting 7 to 8 months. Frosts are frequent during winter months.

The field experiments are located on two distinctly different veld types known locally as the Thornveld and the Mangwe Sandveld. Both are representative of extensive areas in the Colony. (See Henkel J. S. "Types of Vegetation in Southern Rhodesia.")

In the Thornveld the underlying rocks belong to the Basement Schists and the soils are fertile red or grey loams with patches of black soils. In the distant past this region carried a heavy native population and must have been almost completely cleared and extensively cultivated. It has been subjected to very extensive and long continued disturbance by the past native occupants, European farming, and by the timber cutting, road making and other activities of mines, with which it is liberally supplied.

In the Sandveld, the underlying rocks are granite and the soils are usually poor sands. Valleys and flat land have been subjected to extensive disturbance by clearing and cultivation in the past. The hills are largely bare rock or covered with very shallow soils. There are no mining activities in this area.

The vegetation covering the Thornveld and the Mangwe Sandveld is bush, which varies in density from open parkland, in which trees are sparsely studded in grassland, to dense thicket or low forest under which the grasses are largely suppressed.

The main differences in species composition in the two types occur in the early seral stages and in the secondary succession. The grassland in the two veld types is very different both in appearance and in composition. (Footnote 1).

Disturbed sites in the Thornveld are characterised by shrub and tree communities in which various species of *Acacia* (Thorn-trees) are dominant. (Footnote 2). The Mangwe *(Terminalia sericea)* with *Burkea africana*, *Protea abyssinicia* and some other less important trees and shrubs are characteristic of and confined to the Mangwe Sandveld. The majority of the trees and shrubs characteristic of the latter stages of the succession are common to both veld types. (Footnote 3).

The Thornveld grasses provide fair dry season grazing. In the Sandveld the dry season grazing is poor. Hence in local farming practice, where both Mangwe Sandveld and Thornveld are available, stock are wintered in the Thornveld.

THE DEVELOPMENT OF THE STATION.

The development of the station dates back to the 1st October, 1945, on which day the first recruited native labourers began work.

FOOTNOTE 1: *Common Thornveld Grasses*: *Heteropogon contortus* (Spear grass); *Themeda triandra* (Red grass); *Brachiaria serrata*; *Brachiaria spp.* (False paspalums); *Hyparrhenia spp.* (Thatch grass); *Cymbopogon spp.* (Turpentine grass); *Digitaria spp.* (finger grasses); *Setaria spp.* (Timothy grasses); *Urochloa spp.* (False paspalums).

Common Sandveld Grasses Heteropgon contortus (Spear grass); *Trachypogon contortus; Digitaria spp.* (Finger grass); *Chloridion cameronii* (Gilstone grass); *Loudetia simplex* (Russet grass); *Eragrostis chapelieri* (Love grass); *Sporobolus spp.; Andropogon spp.; Pogonarthria squarrosa; Perotis indica; Schizachryrium jeffreysii; Trichoneura grandiglumis; Aristida spp.* (Needle grass); *Hyparrhenia spp.* (Thatch grass).

FOOTNOTE 2: *Acacia karroo, Acacia arabica, Acacia gerrardii, Acacia chariessa, Acacia pallens* and *Dichrostachys glomerata* are all common. *Acacia litakunensis, Acacia davyii, Acacia galpinii* and other *Acacia* spp. occur.

FOOTNOTE 3: *Albizzia spp., Piliostigma thonningii, Boscia spp., Bolusanthus speciosus, Carissa spp., Cassia spp., Combretum spp., Commiphora spp., Diplorrhynchus mossambicensis, Dombeya rotundifolia, Erythrina tomentosa, Ficus spp., Gardenia spp., Gymnosporia spp., Heeria insignis, Kirkia acuminata, Pappea capensis, Peltophorum africanum, Rhus spp., Royena spp., Sclerocarya caffra, Strychnos spp., Thespesia garckeana, Vangueria spp., Zizyphus mucronata* and many other species.

Preliminary surveys which had already been carried out by the Pasture Research Officer, showed that the only land on the Rhodes Matopo Estate which was both available and suitable, consisted of a block of Thornveld known as Two Tree Kop and various scattered patches of Sandveld mainly located on the estate farm known as Hazelside. A site suitable for development as a nursery was obtained on the home farm Westacre Creek.

The fencing of the paddocks and enclosures for the grazing and other field experiments followed detailed plane table surveys of the chosen areas carried out by the Pasture Research Officer.

The location of these various blocks as is shown in the attached map leaves much to be desired from the point of economy in transport and in time and ease of supervision, but it was decided by the Department that these apparent disadvantages were outweighed by the advantage to be obtained from working in close association with an established Animal Husbandry Station and on a Government administered estate on which it was intended to develop an agricultural research station. The land chosen was completely undeveloped and most of it was covered by very heavy bush. In two and one quarter years it has been transformed into a **Pasture Centre for Matabeleland** on which a comprehensive programme of large scale field experiments has been laid down and from which much valuable information is already being obtained.

The following list of completed works will convey the magnitude of the task accomplished by a small but very keen staff: In addition to the Pasture Research Laboratory, the Pasture Research Officer's house, the Assistant Pasture Research Officer's house and the Technical Assistant's house, built with the aid of the Estate staff and the Public Works Department, the following works have been completed by the Pasture Research staff using their own native labour: The Technical Assistant's house at the nursery, the Supervisor's cottage and field laboratory at Two Tree Kop, a house for three single or one married trained African Assistant, toolshed, workshop and ration room at the nursery, fertilizer store and office at the nursery, grass drying barn at the nursery, roofed weighbridge with kraals, crushes and races in the Thornveld, roofed weighbridge with kraals, crushes and races in the Sandveld, repair and roofing of derelict dipping tank in the Thornveld, repair and roofing of derelict dipping tank in the Sandveld, construction of temporary native compounds in the Thornveld, construction of temporary native compounds in the Sandveld, construction of temporary quarters for one African Meteorological Observer and one messenger at the nursery, and pumphouse and tool storeroom at Two Tree Kop.

Just over 47 miles of new fencing have been erected and in addition many miles of existing boundary fencing have been repaired and strengthened. Considerable difficulty and delay was experienced in obtaining the materials needed for this fencing and for most of it slabwood posts and steel railway sleepers had to be used in place of corner posts and standards. This considerably increased the labour involved. Most of the fencing was through dense bush, which had to be cleared and stumped. In

addition to the clearing of these fencing lines, 530 acres have been cleared and stumped in constructing firebreaks and roads and in preparing paddocks for mowing. Over 22 miles of built up earth roads have been constructed.

At Two Tree Kop two boreholes have been sunk, one being equipped with a windmill and the other with an engine driven pump. Water is pumped by the windmill through 1,400 feet of 2 inch piping to a large reservoir which in turn supplies a large brick drinking trough. In the Sandveld two wells have been sunk. Both of these give a strong supply of water. A further 400 feet of 2 inch piping has been laid at the nursery.

The development of irrigated and dry-land nurseries has entailed much labour. This is dealt with in the section devoted to planted pastures and grass leys.

RESEARCH PROGRAMME.

The research work which has been laid down and is being carried out is best grouped under the following headings:—

1. Ecological Survey of the Vegetation.
2. Veld Management Experiments.
3. Veld Burning Experiments.
4. Plant Succession Experiments.
5. Planted Pastures and the Use of Grass Leys in Arable Rotations.
6. Fodder Conservation.
7. Fodder Providing Trees and Shrubs.
8. Reclamation.
9. Water Relations.

1. ECOLOGICAL SURVEY OF THE VEGETATION OF MATABELELAND.

This comprises the following activities:—

(a) The mapping of the units of vegetation with particular reference to the grasslands.

A preliminary reconnaissance of the vegetation of Matabeleland has been started, with the view of demarking the major pasture types and recording any ecological changes which may be in progress.

(b) The collection of specimens and the building up of a station herbarium.

Over 400 different plants have already been mounted. Up to four sheets of each specimen are being mounted to provide duplicate specimens for distribution to other herbaria. The aim is to build up at the station a good working herbarium of the flora of Matabeleland.

2. VELD MANAGEMENT EXPERIMENTS.

In Matabeleland where the proportion of cultivation is so small, the proper management of the indigenous veld grazing to provide the maximum sustained yield and to maintain a vigorous cover of erosion resisting vegetation is obviously the most important objective in the campaign for increased agricultural production and for the conservation of our soil and water. The harm already done by the mismanagement and reckless exploitation of the veld, our most precious natural resource, has already caused a very considerable loss in potential productivity, which is only too plainly shown by widespread denudation and erosion, a less efficient rainfall and a falling water table.

The solution of these problems lies in the removal of the cause of excessive run-off and erosion, that is, in the revegetation of bare ground and in the improvement and maintenance of the veld at its most erosion resisting and productive stage. This can only be done by the application of sound systems of veld management which in turn are dependent on the provision of sufficient fencing and watering points.

The veld management experiments described below are designed to give the information needed for the provision of simple, easily understood systems of grazing management which will afford the maximum grazing capacity while maintaining the veld in good condition at its most productive stage. They cover the wide range of conditions found within the province and characteristic of the development both of a new country as a whole and of many individual farms, from systems suitable for extensive ranching to systems of grazing management suited to more intensive and efficient farming. It should be understood that if from the practical point of view, some of these experiments seem unduly complicated, the complications are necessary for the purpose of obtaining fundamental scientific data.

The general aim of the grazing management experiments is to compare and study the effect on the veld and on the stock of:—

(a) Systems of management in which stock are carried all the year round on veld grazing alone without supplementary feeding.

  i. Yearlong Thornveld grazing.

  ii. Yearlong Mangwe-Sandveld grazing.

  iii. Growing season grazing on Mangwe-Sandveld and dry-season grazing on Thornveld.

(b) Systems of management in which an attempt is made to compensate the deficiencies of dry-season grazing by feeding conserved fodder, in the form of hay or ensilage alone and with the addition of supplements grown on arable land.

In these grazing management trials special attention will be paid to:—

(a) The effects on the veld of the various burning, mowing, grazing and resting treatments involved, particularly with

regard to the changes in the composition and nature of the grass sward induced by the treatments and the effects of the treatments on the density of the bush (trees and shrubs).

(b) The carrying capacity of the veld during the different seasons (i.e. spring, summer, autumn and winter) and throughout the year.

(c) The production and use of veld hay and ensilage, and its use as a dry season supplement to veld grazing.

(d) The use of aftermath for early dry-season grazing.

(e) The relation between the size of the areas needed for use during the growing and the dry seasons in systems where veld grazing alone is depended on.

(f) The relations between the size of the areas required for growing season grazing, hay production and dry season grazing in systems which involve mowing and where hay is used to supplement the dry-season grazing.

(g) The relation between the size of the areas required for growing season grazing, hay production, cultivation and dry-season grazing in systems in which both hay and supplements grown on arable land are fed during the dry season.

It is intended that the grazing management experiments should be regarded as exploratory trials rather than rigid comparative experiments. To begin with, groups of ten steers are being run in year-long grazing management trials on 120 acres of Thornveld, and 150 acres on Mangwe Sandveld. If this rate of stocking proves either too heavy or too light it will be changed by increasing or decreasing the size of the groups. The experimental cattle are weighed every fortnight after overnight kraaling.

A system of botanical analyses designed to show changes in the density and in the composition of the vegetation is being employed. Photography is used as widely as possible to supplement and illustrate the written records.

Experiment 1. Thornveld: The object of this experiment is to investigate the use of a very simple system of deferred rotational grazing by using two paddocks to two herds, except for about three months in the year, when the two herds are grouped in one paddock while the other is rested. No burning or mowing is included.

The system is known as the chess-board system and was devised by R. R. Staples for use in native reserves in Tanganyika where it proved very successful in restoring and improving the quality of the grazing.

In its original form a native reserve was beaconed off into a number of areas which are likened to the black and white squares on a chess board. Each pair of black and white squares constitute on grazing area which is correctly stocked in accordance with the carrying capacity of the area represented by both squares.

The animals are controlled by herding and are encouraged to graze over the entire area of the two squares for the whole of the year except for the latter half of each growing season, during which period one square is rested, while the entire herd is confined to the other square. The squares are rested alternately. Thus, one year the black squares are given a late growing season rest, while the following year the white squares are rested for the same period.

In this experiment fencing has been substituted for beaconing and herding but the method of management employed is essentially the same.

Design and Treatment: 120 acres of typical Thornveld are divided into two paddocks, each 60 acres in extent and of approximately equal carrying capacity. The paddocks are grazed by a group of 10 steers according to the following system:—

The herd is equally divided between the two paddocks,5 steers to each paddock, for the entire year except for a period of about three months beginning about the middle of the growing season, when one paddock is rested, while the entire herd is concentrated in the remaining paddock. This late growing season and autumn rest is given alternately, one paddock one year, the other the next year.

Experiment 2. Thornveld: The object of this experiment is to investigate the use of a three paddock to one herd system of deferred rotational grazing in the management of unmowable Thornveld. Fire is made use of to reduce the density of theexisting bush; to control bush encroachment; and to maintain the grazability of the sward.

Design and Treatment: 120 acres of typical Thornveld are divided into 3 paddocks, each 40 acres in extent and of approximately equal carrying capacity.

These paddocks, in which no bush clearing will be carried out, are grazed by a group of 10 steers according to the following system:—

Paddock	1947/48	1948/49	1949/50	1950/51
A	G.S.	D.S. 2	(B) D.S. 1	G.S.
B	(B) D.S. 1	G.S.	D.S. 2	(B) D.S. 1
C	D.S. 2	(B) D.S. 1	G.S.	D.S. 2

G.S. indicates Growing Season; D.S. indicates Dry Season.

I.—*Fencing the Thornveld Grazing Trials at Two Tree Kop, Matopos.*

II.—*General view of 1 40 acre irrigated beds in the nursery at Matopos. Kudzi vine in the foreground.*

III.—*Napier Fodder, Gold Coast Variety, in the nursery at Matopos.*

IV—*Hillside White Clover under irrigation in the nursery at Matapos.*

Notes:

(1) D.S. 1 is burned after the first good rain and is, thereafter protected from grazing.

(2) During the critical period of early spring growth after the first showers have fallen and before vigorous growth begins, the herd is divided between G.S. and D.S. 2 in order to reduce the grazing pressure as much as possible during this period.

(3) G.S. and D.S. 2 are grazed together until there is sufficient growth in G.S. to support the herd, when D.S. 2 is closed and the herd is concentrated in G.S.

(4) G.S. is grazed during the growing season and as late as possible into the autumn.

(5) The herd is moved into D.S. 1 during autumn or earlier, before the animals begin to lose condition.

(6) D.S. 2 is the reserve dry-season paddock into which the herd is moved from D.S. 1 if and when necessary.

Experiment 3. Thornveld: The objects of this experiment are to investigate the use of a four paddock to one herd system of deferred rotational grazing, where fire is employed to control bush encroachment and to maintain the grazability of the sward in the management of unmowable Thornveld grazing.

Design and Treatment: 120 acres of typical Thornveld are divided into four paddocks, each 30 acres in extent and of approximately equal carrying capacity. These paddocks, in which no bush clearing will be carried out, are grazed by a group of 10 bullocks according to the following system:—

Paddock	1947/48	1948/49	1949/50	1950/51	1951/52
A	G.S.	R	(B) D.S. 1	D.S. 2	G.S.
B	R	(B) D.S. 1	D.S. 2	G.S.	R
C	(B) D.S. 1	D.S. 2	G.S.	R	(B) D.S. 1
D	D.S. 2	G.S.	R	(B) D.S. 1	D.S. 2

G.S. indicates Growing Season; D.S. indicates Dry Season.

Notes:

(1) D.S. 1 is burned after the first good rain and is thereafter protected from grazing.

(2) During the critical period of early spring growth after the first showers and before vigorous growth begins, the herd is divided between G.S., D.S. 2, and R in order to reduce the grazing pressure as much as possible.

(3) G.S. is closed as soon as there is enough growth in D.S. 2 and R to support the herd and is rested for a short period in order to enable the grass to come away sufficiently to provide summer grazing.

(4) When G.S. is ready, D.S. 2 and R are closed and the herd is concentrated in G.S.

(5) The herd is shifted into D.S. 1 during autumn or at the beginning of winter, before the animals begin to lose condition.

(6) D.S. 2 is the reserve winter paddock into which the herd is moved from D.S. 1 when a move becomes necessary. (If absolutely necessary, because of prolonged drought or other unpredictable circumstances R will be used as reserve grazing).

An arrangement of four paddocks to one herd provides a very flexible design for the management of grazing and enables the system to be varied within wide limits.

Experiment 4 Thornveld: This is a five paddock to two herd system of deferred rotational grazing for the management of unmovable Thornveld, developed and successfully used by L. O. F. Irvine in the Northern Transvaal. It is widely advocated in the Union of South Africa for certain types of unmowable semi-sweet veld, where burning is necessary to combat the danger of bush encroachment; and also for unmowable mixed veld where-ever bush encroachment threatens. (L. O. F. Irvine, "The Major Veld Types of the Northern Transvaal and their Grazing Management," Quinquennial Report of the Toowoomba Pasture Research Station). Burning is included as in Experiment 2 and for the same reasons.

Design and Treatment: 120 acres of typical Thornveld are divided into five paddocks each 24 acres in extent and of approximately equal carrying capacity. These paddocks, in which no bush clearing will be carried out, are grazed by a group of 10 steers divided into two herds of five each.

The burning and grazing treatments are carried out according to the following plans:—

Paddock	1947		1948		1949		1950		1951	
	Mid G.S. to Mid D.S.	Mid D.S. to Mid G.S.	Mid G.S. to Mid D.S.	Mid D.S. to Mid G.S.	Mid G.S. to Mid D.S.	Mid D.S. to Mid G.S.	Mid G.S. to Mid D.S.	Mid D.S. to Mid G.S.	Mid G.S. to Mid D.S.	Mid D.S. to Mid G.S.
1		A		(B1)	B		A			burn (B2)
2	B		A			burn (B2)		A		(B1)
3		burn (B2)		A		(B1)	B		A	
4		(B1)	B		A			burn (B2)		A
5	A			burn (B2)		A		(B1)	B	

Year	Mid G.S. to Mid D.S.	Mid D.S. to Early G.S.	Early G.S. to Mid G.S.	Burn at end of D.S.
1947	2 and 5	1 and 4	1 and 3	3
1948	2 and 4	1 and 3	5 and 3	5
1949	1 and 4	5 and 3	5 and 2	2
1950	1 and 3	5 and 2	4 and 2	4
1951	5 and 3	4 and 2	4 and 1	1

Notes:

G.S. indicates Growing Season; D.S., Dry Season; A, Herd A; B, Herd B and the symbols in brackets a shorter grazing period than normal.

From mid-dry season to early growing season use is made of the reserve camp in lieu of the camp which was burned at the end of the dry season in order to allow the veld of the latter camp to make good growth before being grazed from early growing season to mid-growing season.

Experiment 5 Thornveld: The object of this experiment is to investigate the use of a semi-intensive four paddock to one herd system of deferred rotational grazing in the management of mowable Thornveld. Mowing is employed to control bush encroachment; to maintain the grazability of the sward; and to provide late aftermath grazing and hay for dry season feeding.

Design and Treatment: 120 acres of typical Thornveld are divided into four paddocks, each 30 acres in extent and of approximately equal carrying capacity. These paddocks, after having been cleared to mowable parkland, are grazed by a group of 10 steers according to the following system:—

Paddock	1947/48	1948/49	1949/50	1950/51
A	M.1	M.2	M.3	G.S.
B	M.2	M.3	G.S.	M.1
C	M.3	G.S.	M.1	M.2
D	G.S.	M.1	M.2	M.3

G.S. indicates Growing Season; D.S. indicates Dry Season.

Notes:

(1) During the critical period of early spring growth, after the first rains have fallen and before vigorous growth commences, the herd is spread over the entire area (4 paddocks) in order to reduce the grazing pressure as much as possible during this period.

(2) G.S. is closed as soon as there is enough grazing in M.1, M.2 and M3 to support the herd, and is rested for a short while, in order to enable the grass to come away sufficiently to provide summer grazing.

(3) When growth begins to quicken the herd is concentrated in G.S. and the hay paddocks M.1, M.2 and M.3, are put up for hay production. They are mown for hay as soon as a good yield can be obtained.

(4) When vigorous growth ceases the herd is transferred to the aftermath in M.1, and thence to M.2 and M.3.

(5) Later when necessary, the steers are removed to pens to be fed on hay.

Experiment 6 Thornveld: In this experiment, by the use of a comparatively large herd in small paddocks, a study will be made of:—

(a) The reaction of Thornveld to intensive grazing and mowing during the growing season under a deferred rotational system of management.

(b) The carrying capacity of intensively grazed Thornveld throughout the growing season.

(c) The use of aftermath grazing in prolonging the grazing season.

(d) The yield and value of veld hay and the area required to provide sufficient hay for dry season maintenance.

Design and Treatment: 120 acres of typical Thornveld are divided into eight paddocks, each 15 acres in extent and of approximately equal carrying capacity. These paddocks after having been cleared to mowable parkland, are grazed by a herd of 10 steers and mown for hay according to the following system:—

Paddock	1947/48	1948/49	1949/50
A	Graze Mid G.S.	Graze early G.S. and late G.S.	Graze early G.S. and very late G.S.
B	Graze early G.S. and late G.S.	Graze early G.S. and very late G.S.	Hay & Aftermath 1
C	Graze early G.S. and very late G.S.	Hay & Aftermath 1	Hay & Aftermath 2
D	Hay & Aftermath 1	Hay & Aftermath 2	Hay & Aftermath 3
E	Hay & Aftermath 2	Hay & Aftermath 3	Hay & Aftermath 4
F	Hay & Aftermath 3	Hay & Aftermath 4	Hay & Aftermath 5
G	Hay & Aftermath 4	Hay & Aftermath 5	Graze Mid G.S.
H	Hay & Aftermath 5	Graze Mid G.S.	Graze early G.S. and late G.S.

Notes:

To commence with three paddocks will be used for grazing and five for hay production and aftermath grazing. If it becomes necessary to adjust the relative sizes of the grazing and mowing areas, this will be done by adding to and subtracting from the present allocation.

(1) Grazing begins when the grass has commenced to grow.

(2) At first, in order to spread the grazing pressure as much as possible during the critical period of early spring growth, a daily rotation through the 8 paddocks is employed, i.e. the herd is shifted to a fresh paddock each day.

(3) As soon as there is sufficient growth to warrant it, the herd is divided between the two early and late-growing season paddocks until the mid growing-season paddock is sufficiently advanced to support it.

(4) The herd is then concentrated in the mid-growing season paddock and is kept there until it becomes necessary to move first to the early-and-late-growing season paddock, then to the early and very-late-growing season paddock and finally to the hay and aftermath paddocks Nos. 1, 2, 3, 4 and 5.

(5) As soon as the animals show signs of beginning to lose weight they are moved to pens for feeding.

(6) In preparation for the next season's grazing and mowing the paddocks that were grazed are evened up by mowing during the dry season.

Experiment 7, Mangwe Sandveld: (The chess board system.) Two paddocks to two herds except for about three months in the year, when the two herds are grouped in one paddock while the other is rested. No burning or mowing).

Experiments 7, 8 and 9 are similar in design and treatment to Experiments 1, 2 and 3 respectively on Thornveld, except that 150 acres of Sandveld are used to carry the ten experimental steers, owing to the lower carrying capacity of this type of veld.

Experiment 8, Mangwe Sandveld: (Three paddocks to one herd with burning).

Experiment 9, Mangwe Sandveld: (Four paddocks to one herd with mowing).

Experiment 10, Mangwe Sandveld: (Intensive summer grazing and hay production).

See Experiment 6.

Design and Treatment: 150 acres of typical Mangwe Sandveld are divided into 10 paddocks each 15 acres in extent and of approximately equal carrying capacity. These paddocks, after

having been cleared to mowable parkland, are grazed by a herd of 10 steers and mowed for hay according to the following system:-

Paddock	1947/48	1948/49	1949/50
A	Hay & Aftermath 5	Hay & Aftermath 4	Hay & Aftermath 3
B	Hay & Aftermath 6	Hay & Aftermath 5	Hay & Aftermath 4
C	Hay & Aftermath 7	Hay & Aftermath 6	Hay & Aftermath 5
D	Graze Mid G.S.	Hay & Aftermath 7	Hay & Aftermath 6
E	Graze early G.S. and late G.S.	Graze Mid G.S.	Hay & Aftermath 7
F	Graze early G.S. and very late G.S.	Graze early G.S. and late G.S.	Graze Mid G.S.
G	Hay & Aftermath 1	Graze early G.S. and very late G.S.	Graze early G.S. and late G.S.
H	Hay & Aftermath 2	Hay & Aftermath 1	Graze early G.S. and very late G.S.
I	Hay & Aftermath 3	Hay & Aftermath 2	Hay & Aftermath 1
J	Hay & Aftermath 4	Hay & Aftermath 3	Hay & Aftermath 2

G.S. indicates Growing Season.

Note:

See Experiment 6 for management.

PROGRESS OF THE VELD MANAGEMENT EXPERIMENTS.

Season 1946/47: The commencement of grazing in the veld management experiments coincided with the severest drought in the history of Matabeleland. Because of this and because the grazing paddocks had been grazed during the winter of 1946 and burned after the first rains in November, 1946, in order to obtain a clean and comparable start for the experiments, there was insufficient grass in the paddocks to begin grazing until late in January. Grazing began in the Thornveld experiments on 15.1.47 and in the Sandveld on 23.1.47.

Five inches of rain in January were followed by less than one inch in February and less than one inch in March. No rain fell in April. As there was practically no growth from the end of January, the experimental rotations could not be carried out. It was decided to keep the steers in the paddocks for as long as possible by using dry season reserve grazing.

The Sandveld experiments were closed on 27.3.47. In the Thornveld at Two Tree Kop, where there was still some grazing, the groups were halved and half groups of five animals each were grazed in each experiment from 27.3.47 to 3.6.47. Most of these half groups continued to put on weight until 19.5.47. They began to fall in weight before 3.6.47. On this date the Thorn veld experiments were closed and the cattle removed, since the paddocks were beginning to show signs of overgrazing and trampling.

Season 1947/48: In the light of experience gained during the 1946/47 season, the original experimental programme was modified and some of the experiments were changed.

The 1947/48 growing season began very well with 0.68 inch of rain in September, 2.68 inch in October, 1.92 inch in November and 9.99 inch in December. Because all the paddocks had been grazed down during the previous dry season, no burning treatments could be carried out in the Grazing Management Experiments at the beginning of the 1947/48 growing season. The steers were regrouped before grazing commenced by averaging three consecutive weighings made on the 8th, 9th and 10th of December, 1947.

Grazing began in the Thornveld experiments on 12.12.47 and in the Sandveld experiments on 15.12.47. The average individual gain from 9.12.47 to 31.12.47 of the Thornveld groups was 3.46 lb. per day. The Sandveld groups showed an individual gain of 2.83 lb. per day for the period 9.12.47. to 7.1.48.

3. VELD BURNING EXPERIMENTS.

Experiment 11, Thornveld: Burning without grazing in typical "undisturbed" Thornveld on heavy black soil at Two Tree Kop.

The object of this experiment is to study the effects of:—

(a) Burning at different seasons of the year and at different intervals.

(b) Mowing.

(c) Protection from burning and mowing (on indigenous veld which is protected from grazing).

Design: Twelve treatments are replicated three times in randomised blocks. The plots are ¼ acre in area, separated by firebreaks ten yards wide, and will be treated as follows:—

1. Complete protection.
2. Burned annually in autumn.
3. Burned annually at the end of the dry season before the first rains.
4. Burned annually in early spring before the rains set in.
5. Burned every second year in autumn.
6. Burned every second year at the end of the dry season before the first rains:
7. Mown for hay.
8. Burned every third year in the mid-growing season.
9. Burned every third year at the end of the dry season before the first rains:
10. Burned every third year in early spring before the rains set in.
11. Burned every fifth year at the end of the dry season before the first rains.
12. Mown annually at the end of winter.

Note:

In treatments 7 and 12, the plots were cleared for mowing at the commencement of the experiment.

"Early Spring before the rains set in" means as late as possible to achieve a good burn, normally after the first good rain, but before there is much shooting.

"Autumn" means as soon as the grass is dry enough to burn well. "Before the first rains" means definitely before any rain has fallen.

Experiment 12, Thornveld: Burning without grazing in typical "undisturbed" Thornveld on heavy red soil at Two Tree Kop.

The objects, design and treatments are the same as in Experiment 11.

Experiment 13, Mangwe Sandveld: Burning without grazing in typical "undisturbed" Mangwe Sandveld.

The objects, design and treatments are the same as in Experiment 11.

Experiment 14, Thornveld: Burning with grazing in typical "undisturbed" Thornveld on heavy black soil at Two Tree Kop.

The object is to study the effect of different combinations of treatments on indigenous veld with particular reference to their effect on the existing bush and on the invasion of open grassland by bush.

Design: Eight 10 acre paddocks of typical veld are treated as follows:—

1. Intermittent heavy grazing — no mowing — no burning.
2. Moderate grazing — no mowing — no burning.
3. Burned in early spring, before the rains set in, once in three years, after a half season rest and followed by a half season rest. Moderate grazing.
4. Burned in early spring, before the rains set in, once in four years after a full-season rest and followed by a full-season rest. Moderate grazing.
5. Burned in early spring, before the rains set in, once in four years after a full-season rest and followed by a half-season rest. Moderate grazing.
6. Burned in early spring, before the rains set in, once in four years after a full-season rest and followed by a short rest. Moderate grazing.
7. Mown every year during winter to even up for grazing. Moderate grazing.
8. Mown every fourth year for hay and every winter to even up for grazing. Moderate grazing.

Note:

In treatments 7 and 8 the plots were cleared for mowing at the commencement of the experiment.

For definition of terms see Experiment 11.

Experiment 15, Mangwe Sandveld: Burning with grazing in typical "undisturbed" Mangwe Sandveld.

The objects, design and treatments are the same as for Experiment 14, except that two acre paddocks are in use instead of ten acre paddocks.

PROGRESS OF THE VELD BURNING EXPERIMENTS.

The burning and mowing treatments in Experiments 11 and 13, Burning without Grazing, at Two Tree Kop and in the Sandveld were commenced at the end of the dry season, September, 1947. Due to lack of cover very poor burns were obtained. An additional burning without grazing experiment, Experiment 12, has been laid out in Themeda veld at Two Tree Kop. Treatments will commence at the beginning of the dry season 1948.

The grazing treatments in Experiments 14 and 15, burning with grazing in the Thornveld and in the Sandveld, began early in December, 1947. Lack of cover made it impossible to carry out any burning treatments this year in the burning with grazing experiments.

4. PLANT SUCCESSION EXPERIMENTS.

Experiment 16, Thornveld: This is an ecological study to demonstrate the effect on the veld of:—

(a) Heavy grazing continued over a number of years.
(b) Protection from grazing of veld which has been subjected to heavy grazing.

Design and Treatment: This is as follows:--

1948/49		1948/49
1949/50		1949/50
1950/51		1950/51
1951/52		1951/52
1952/53		1952/53
1953/54		1953/54
1954/55		1954/55
1955/56		1955/56
1956/57		1956/57
1957/58		1957/58
1958/59		1958/59
1959/60		1959/60
1960/61		1960/61
1961/62		1961/62
1962/63		1962/63
This corridor is grazed heavily from the beginning of the 1947/48 growing season. Thereafter, at the beginning of each growing season one plot will be cut off by fencing and remain protected.	This corridor is protected from the commencement of the 1947/48 growing season.	This corridor is protected from grazing from the beginning of the 1947/48 growing season. Thereafter, at the beginning of each growing season one plot will be opened to heavy grazing.

Experiment 17, Mangwe Sandveld: The objects, design and treatment are the same as in Experiment 16.

Experiment 18, Thornveld: The object of this experiment is to study the effect of fixed (i.e. for the same period of the year annually) seasonal resting and grazing on the veld.

Design and Treatment: Six ½ acre paddocks located in typical "undisturbed" Thornveld are subjected to the following treatments:—

1. Complete protection.
2. Kept closely grazed during the first half of the growing season. Protected for the rest of the year.
3. Kept closely grazed during the second half of the growing season. Protected for the rest of the year.
4. Protected for the second half of the growing season. Kept closely grazed during the rest of the year.
5. Kept closely grazed during the entire growing season. Protected during the dry season.
6. Kept closely grazed during the entire dry season. Protected during the growing season.

Experiment 19, Mangwe Sandveld: (Fixed seasonal resting and grazing in the Sandveld).

The objects, design and treatment are the same as in experiment 18.

PROGRESS OF THE PLANT SUCCESSION EXPERIMENT.

Grazing began in Experiments 16 and 17 at the beginning of the 1947/48 growing season.

Grazing will commence in Experiments 18 and 19 at the end of the 1947/48 growing season. It will be some years before definite changes in the vegetation will be noticeable.

5. PLANTED PASTURES AND GRASS LEYS.

Planted pastures, because of their unique ability to maintain and build up fertility when used as leys in arable rotations, must inevitably play an increasingly vital role in the Colony's agriculture. The importance of this branch of the work was fully recognised when the programme of work was originally drafted and the first undertaking, when the Central Veld and Pasture Station began its work in October, 1945, was the establishment of a nursery of small irrigable beds for the introduction, preliminary trial and bulking up of a collection of possibly useful varieties of grasses and legumes.

At present the nursery consists of:—

(a) Sixty-six small level irrigable beds of approximately 1/40th acre in size.

(b) Fourteen graded border strip irrigable beds of 1/10th acre in size.

(c) Twenty dry land beds of 1/10th acre size (not including a 3 ft. border right round each bed).

The dry-land nursery is being extended and a further series of irrigable beds are being laid down. An additional dry-land area has been developed for the bulking up of grasses for distribution and for seed production.

PROGRESS.

The first task undertaken was the bulking up by vegetative propagation of the original collection of grasses which were received from the Prinshof Grass Breeding Station, Pretoria. To illustrate the success achieved in this task, the history on this Station of the Gold Coast and Cameroons strains of Napier Fodder may be noted. Small packages of these two strains together with 35 other selected grasses were received from Prinshof at the end of September, 1945. About six rooted shoots of each of the two strains of Napier Fodder were received. From this original introduction slightly more than ¼ acre of each variety is already established while eighteen grain bags of roots have been distributed to farmers for trial.

Other grasses which have been bulked up vegetatively on the same scale include: *Napier Fodder*, R.M.E. strain; *Setaria sphacelata*, Kazungula strains Nos. 1192 and 1193; *Setaria sphacelata*, R.M.E. strain; *Echinochloa pyramidalis*, Limpopo strain; *Panicum coloratum*, Makarikari strains No. 1412, No. 1112 and Arnold's; *Cenchrus ciliaris*, Zeerust strain: *Panicum sp.*, Sibinini strain; *Panicum sp.*, Bushman Mine strain; *Panicum maximum*, R.M.E. strain: *Bothriochloa insculpta*; *Urochloa spp.*; *Digitaria spp.*, Waterfall strain; *Digitaria spp.*, R.M.E. strain: *Phalaris arundinacea*, Prinshof selection; *Phalaria tuberosa*, Prinshof selection; Tall Fescue, Prinshof selection: *Bromus catharticus*, Prinshof selection, as well as several strains of *Star Grass (Cynodon plectostachyum)*.

The nursery at present contains a collection of approximately 250 grasses and legumes, both exotic and indigenous, received from other institutions or collected locally by the station staff. From this collection promising grasses and legumes are being selected:—

(a) For use in dry-land pastures and structure building leys on arable land, etc.

(b) For use as structure building leys under irrigation:—

  (i) Winter green varieties for irrigated pastures;

  (ii) Heavy yielding summer-growing varieties, capable of producing under irrigation, high yields of green feed and ensilage during the warm, dry months.

(c) For use in reclamation and soil conservation projects etc.

The work is still in the preliminary stage, but already many of the more promising varieties have been distributed to farmers and other institutions for trial (87 bags of grass roots were distributed during the year 1947) and many will, from the beginning of the next season *onwards*, be put out in field scale grazing trials on the Central Veld and Pasture Station at Matopos and at the Nyamandhlovu Pasture Sub-Station.

Dry-land Pastures: Special attention is being devoted to the selection of grasses and legumes suitable for dry-land pastures and of the grasses thus far tried, the most promising are:—

Panicum coloratum, Makarikari strain, No. 1412. Both at Matopos and at Nyamandhlovu this grass is outstanding. It sends out runners which root readily and in stands in which rooted runners were planted at 3 feet intervals, a dense cover was very quickly established, and a heavy yield of hay obtained in the first season. *Panicum coloratum*, Makarikari strain No. 1112, is an erect type which does not send out runners. *Cenchrus ciliaris*, Zeerust strain, has an erect habit and produces large quantities of viable seed. *Panicum spp.*, Bushman Mine and Sibmini strains are low growing stoloniferous grasses which produce a very dense cover and appear to be capable of standing up to heavy grazing. They take off slowly and do not produce a cover as quickly as Makarikari No. 1412. *Digitaria sp.*, Waterfall and R.M.E. strains are similar in habit, both produce a dense cover by sending out runners which root at the nodes and both are very slow in taking off. *Urochloa sp.*, this grass was introduced by the Pasture Research Officer from the lower reaches of the Shashi in the extreme south of the Matobo District. It covers very rapidly and appears to be a particularly useful grass.

Several other promising introductions from various parts of Matabeleland include very fine varieties of *Panicum coloratum* from Jhilo on the Shashi and from Bambatsi on the Manzimnyama. *Panicum repens* and a variety of Napier Fodder from the Sebungwe district, and *Hemarthria sp.*, a *Panicum sp.*, a *Pennisetum sp.*, and two unknown grasses from the Gwaai Native Reserve.

The work already carried out has shown that although many of the grasses under trial are suitable for use in pasture leys under dry-land conditions, practically none of the suitable varieties can be established by seeding. Because the establishment of planted pastures by planting runners or roots is both costly and slow, a solution of the problem is being sought in the selection of varieties which produce quantities of viable seed and in the mechanisation of the planting of roots or runners.

The search for suitable legumes for dry land pastures provides a particularly difficult problem. The clovers and other legumes grown in temperate climates need more water than the climate provides. They do not survive under dry land conditions though they thrive under irrigated conditions. Most of the indigenous legumes are unpalatable and sometimes poisonous. Contact has been established with other stations in the U.S.A., in Australia and elsewhere and a collection of dry-land legumes at Matopos

is being built up. The possibilities of our own indigenous legumes and legumes from Africa generally are not being neglected in this search. It is considered that the solution may lie in the use of free-seeding summer-growing annual legumes able by re-establishing themselves annually under summer rainfall conditions to fill a similar role to that played by Subterranean clover in the winter rainfall areas.

Promising results in the preliminary trials have been obtained with *Glycine javanica*, *Indigophera endacophylla*, *Lespedeza sericea* and *Lespedeza striata*.

Fodder Grasses. There is an urgent need for grasses capable of producing heavy yields of green fodder or ensilage on dry land and under irrigation.

In this class encouraging results are being obtained from: *Napier Fodder*, Cameroons strain; *Napier Fodder*, Gold Coast strain; *Setaria sphacelata*, Kazungula strain No. 1192; *Setaria sphacelata*, Kazungula strain No. 1193; *Echinochloa pyramidalis*, Limpopo strain. These grasses are being tried both under irrigation and on dry land.

Preliminary results indicate that the yield obtained from Napier Fodder may be considerably influenced by the cultural practices used. Espacement, frequency of cutting and the height above ground level at which the canes are cut, all appear to exercise a very marked effect on the yield obtained, and on the vigour of the stand. These factors will be investigated under dry land conditions in an experiment which has been planned and will be begun at the beginning of the 1948 49 season.

Note. The following green weight yields per acre were obtained from 1/10th acre plots in the dry land nursery at Matopos:—

Napier Fodder (Cameroons) . . .	63,750 lbs.
Napier Fodder (Gold Coast) .	60,050 lbs.
Setaria sphacelata (Kazungula No. 1192). .	47,810 lbs.
Setaria sphacelata (Kazungula No. 1193) ..	36,150 lbs.
Echinochloa pyramidalis	37,500 lbs.

The Napier Fodders were established on 18/11/47 and the *Echinocholoa* and two Kazungula *Setarias* on 2/12/47. All were cut on 1/6/47. They were established from roots at 3 ft. intervals in new beds on good virgin soil. The beds received no irrigation, fertiliser or compost.

Irrigated Pastures: Recent work in the U.S.A. has shown that in terms of feed equivalents the forage yield of a well managed irrigated grass-legume pasture compares favourably with that of a stand of lucerne on the same ground where conditions are suitable for lucerne and that it exceeds it in marginal areas where lucerne does not do so well. In comparisons made in the cost of the feed produced, the feed produced on irrigated pastures and harvested by grazing live stock has a very big

advantage. Apart from the economic viewpoint, the use of pastures in rotations on irrigated land is most useful in order to maintain structure and fertility.

The principal use for irrigated pastures on irrigation settlements and elsewhere in the Colony would be to provide high quality grazing for dairy cows during the dry season. Because of this our efforts so far have been concentrated on the selection of suitable winter-green grasses and legumes capable of affording good grazing during the cold dry months when low night temperatures inhibit the growth of the summer growing species.

For the above purpose encouraging results have been obtained from the following grass-legume mixtures: *Phalaris arundinacea* (Prinshof selection) with White clover (Hillside strain); Tall Fescue (Prinshof selection) with White clover (Hillside strain): *Bromus catharticus* (Waite Institute Selection) with Egyptian clover. The Hillside White clover was obtained from a vlei in which it is naturalised on the former Hillside Wheat Breeding Station near Salisbury. It closely resembles Aberystwyth S. 100.

Several other varieties and strains of winter green temperate grasses are under trial but it is still too early to report on them. The growing of legumes under irrigation has presented no difficulties. All varieties tried with exception of Subterranean Clover have done very well. Of the lucerne varieties, a strain called "India" obtained from the U.S.A. Department of Agriculture, is notably better here than any of the other varieties under trial.

6. FODDER CONSERVATION.

Much attention is being paid to the problem of fodder conservation, particularly with regard to the production and utilization of high quality veld hay and the production of ensilage from veld and from high yielding grasses, legumes, etc., on cultivated land.

Owing to weather conditions considerable difficulty has been experienced in making veld hay at the time when the protein content is still relatively favourable. In order to circumvent this difficulty the usefulness of tripods, drying barns, mow drying and various types of shelters is being investigated. Attention is also being paid to the mechanisation of hay making.

7. FODDER TREES AND SHRUBS.

The culture and propagation of promising fodder trees and shrubs is receiving attention. Early in 1947 plantings were made of seeds of five different fodder trees obtained from the Prinshof Grass Breeding Station. The species planted were: Mexican Hawthorn, Mesquite, Honey Locust, Carob and *Brachychiton populinum*. Germination of all of these seeds was poor and only a few seedlings were raised. A second attempt, after the seeds had been soaked in boiling water gave no better results. One hundred Honey Locust seedlings have been planted along the top of the dry nursery and are doing well.

Besides the above, seeds of *Acacia giraffae* (Camel Thorn), *A. woodii* (Mlala Dwai) and *A. albida* (Umpumpu) were collected and planted. Of these the *A. giraffae* germinated well and *A. albida* **badly**. Germination of the *A. woodii* was also poor. An avenue of *A. giraffae* and *A. woodii* is being planted along the road below the 15 acre paddocks in the Malemi valley. So far about 100 of the former and 30 of the latter have been planted. The road running between the paddocks 2 and 3 has also been lined with *A. giraffae* seedlings. It is intended to establish avenues of as many different varieties of fodder trees as can be obtained both in the sandveld and in the thornveld in order to investigate and to compare the value of the various species under the conditions at Matopos

8. RECLAMATION.

Revegetation of Denuded and Eroded Areas: Very successful results have been obtained in the revegetation of old roads and other denuded areas in the thornveld by covering the bare ground with a mulch of cut down thorn trees and brushwood. The mulch, which is put down thinly, supplies shade and protection. It holds up run-off water and prevents erosion. The soil under the mulch tends to keep moister than the surrounding uncovered soil Seeding of these protected areas has so far proved unnecessary as sufficient seed is blown or washed in from the surrounding vegetation to establish a good cover in a comparatively short time. This work is being continued.

Bush Eradication: A number of thorn tree poisoning experiments were initiated. Eight batches of 100 trees were treated with illuminating paraffin, power paraffin and arsenite of soda respectively Each tree was labelled, and its height and girth recorded A tree-stabber, made locally, has also been tried out This work is being continued.

Control of Bush Encroachment: This problem has been reviewed recently by the Pasture Research Officer in the "Rhodesia Agricultural Journal" (O. West, "Thorn Bush Encroachment in Relation to the Management of Veld Grazing," "Rhodesia Agricultural Journal 44: 488-497, 1947. Also Bulletin No. 1417, Department of Agriculture and Lands, Southern Rhodesia.)

9. WATER RELATIONS.

Run-off and Erosion: As soon as cement becomes available an experiment will be laid down in which run-off under different conditions of cover and treatment will be measured and compared. It is also hoped that it will be possible to begin work shortly on the use of grass strips in place of contours for the protection of certain types of arable land.

A comprehensive scheme of research in the efficiency of the rainfall, the correlation of the soil moisture with the rainfall and the comparative value of various types of plant cover in conserving water supplies will be initiated as soon as sufficient staff becomes available.

Conservation of Streambanks, Vleis and Sponges: Two sponge areas which give rise to valuable springs in the Sandveld experimental area have been fenced off and are being afforded protection from grazing and fire. Succession studies, measurements of the water table depth, study of the effects of the developing vegetation on the area, etc., will be initiated as soon as possible.

10. PUBLICATIONS.

1. West, O. and J. M. Rattray: "Research Programme on Veld and Pasture Management in Southern Rhodesia." Bull. 38 of the Imperial Bureau of Pastures and Field Crops; pp. 5-22 (1947).

2. West, O.: "Thorn Bush Encroachment in Relation to the Management of Veld Grazing." "The Rhodesia Agricultural Journal," XLIV. 5, pp. 488-497 (1947).

3. West, O.: "Larval Parasite of *Dichapetalum cymosum*: "South African Science" I., 3, pp. 68-69 (1947).

4. West, O.: "Umkouzaane" (*Dichapetalum cymosum*). "The Rhodesia Agricultural Journal," XLIV., No. 6, pp. 609-613 (1947).

Southern Rhodesia Veterinary Report

APRIL, 1948.

General. Water and grazing have been plentiful in all districts and cattle are in good condition.

Tick Life is reported to be active.

Diseases. African Coast Fever—

Salisbury District. No cases on any of the infected farms.

Melsetter and Chipinga Districts. No cases on any of the infected farms.

Anthrax. No cases reported.

Trypanosomiasis. In Chipinga District twenty further cases were reported. An intensive inspection was made in the Mkoto Reserve and infection appears to be widespread in the Reserve.

Lumpy Skin Disease. No cases reported.

Quarter Evil. Reported in all districts except Umtali.

Epi-Vaginitis. No cases reported.

Theileriosis. Three deaths were reported in the Salisbury district.

Heart Water. No cases reported.

Anaplasmosis. Numerous cases reported in the Salisbury, Bulawayo, Fort Victoria and Melsetter districts.

Piroplasmosis. Five cases were confirmed in the Salisbury and Bulawayo districts.

Stiff Sickness is reported to be heavy in all districts.

Sweating Sickness is prevalent in all districts.

Horse Sickness. The incidence has been the highest recorded for many years and deaths have occurred even among inoculated horses.

Paratyphoid. A severe but localised outbreak occurred in the Fort Victoria district.

FOOT AND MOUTH DISEASE.

Fort Victoria District. In the Buhera district there was an extension of the disease to the northern section of the non-dipping area. The existing cordon was altered slightly to accommodate the change and the cattle free belt between the cordon and the Buhera dipping was widened.

There was no change in the Bikita area.

Chipinga-Melsetter District. No extension of the disease occurred.

Umtali Veterinary District.

(a) **Maranka Reserve.** Extensions of the disease involved the remainder of the Reserve not already infected. All cattle were moved further south in the Reserve and a cattle free belt established in the northern section. The cordon was altered to accommodate this.

(b) **Adjoining European Farms.** The disease spread to some of the European farms adjoining the Maranka Reserve. However only a small number became infected and the disease does seem to be losing some of its virulence and a definite halt in the spread seems very possible. A small internal cordon was placed round the infected farms.

R.A.R. Detachment. A detachment of the R.A.R. was sent to the area for cordon duty and has been posted on the external cordon line.

Mallein Testing. Sixty-six horses and 12 mules were tested with negative results.

Tuberculin Testing. Sixty-nine bulls, 12 cows, 11 heifers and one yearling were tested with negative results.

IMPORTATIONS.

Union of South Africa. Bulls (breeding) 24, horses and mares 32, geldings 31, cows and calves 172, mules 12, sheep (breeding) 57, pigs (breeding) 3.

Northern Rhodesia. Horses and mares 3.

Bechuanaland Protectorate. Oxen (slaughter) 903, cows (slaughter) 395, bulls (slaughter) 98.

EXPORTATIONS.

Union of South Africa. Bulls (breeding) 1 (failed test).

Belgian Congo. Bulls (breeding) 28, pigs (breeding) 29.

Portuguese East Africa. Oxen (slaughter) 88, sheep (breeding 130.

Northern Rhodesia. Pigs (breeding) 4, mules 1.

EXPORTATIONS—MISCELLANEOUS.

In Cold Storage.

Union of South Africa. Dripping 4,334 lbs., sausage casings 24,241 lbs.

Belgian Congo. Goat meat 10,249 lbs., offal 9,671 lbs., beef 203,696 lbs., veal 6,682 lbs.

Bechuanaland Protectorate. Offal 296 lbs., sausage 228 lbs., dripping 240 lbs., bacon 149 lbs., pork 82 lbs., brawn 12 lbs.

Portuguese East Africa. Offal 3,503 lbs., beef 8,007 lbs., bacon 1,002 lbs., mutton 1,502 lbs.

Northern Rhodesia. Offal 15,578 lbs., beef 337,948 lbs., veal 117 lbs., dripping 1,382 lbs., bacon 10,608 lbs., gammon 945 lbs., pork 127 lbs.

Meat Products from Liebig's (Rhodesia) Ltd., West Nicholson.

Union of South Africa. Ox bungs 580 lbs., beef middles 510 lbs., weasands 32 lbs.

D. A. LAWRENCE,
Acting Director of Veterinary Services.

MAY, 1948.

General. Grazing has been plentiful in most districts and cattle are in good condition

Tick Life is reported to be prevalent though there are signs of a decrease in activity.

Diseases. African Coast Fever

Salisbury District. No cases on any of the infected farms.

Melsetter and Chipinga Districts. No cases on any of the infected farms.

Anthrax. No cases reported.

Trypanosomiasis. In the Chipinga district 44 cases were reported. 1,553 (Phenanthridinum) injections giving rapid recovery in three to four days. In the Mkoto Reserve 53 head were found to be infected and all cattle injected. A survey of the Chimanda Reserve produced negative results.

Lumpy Skin Disease. A very mild outbreak occurred on a farm in the Salisbury district.

Quarter Evil. Reported in the Salisbury, Fort Victoria and Melsetter districts.

Epi-Vaginitis. Reported on two farms in the Salisbury district.

Theileriosis. No cases reported.

Heart Water. No cases reported.

Anaplasmosis. Numerous cases were reported in all districts.

Piroplasmosis. Cases were confirmed in the Salisbury and Umtali districts.

Stiff Sickness is diminishing in all districts.

Sweating Sickness is still numerous in the Salisbury district.

Horse Sickness. Cases were confirmed in the Salisbury and Gwelo districts.

Sterility. Inspection of a dairy herd in Bulawayo showed 25 per cent. only in calf and over 50 per cent. with active vaginitis or metritis.

FOOT AND MOUTH DISEASE.

Fort Victoria Veterinary District. No further outbreaks were recorded. The inoculations in the Buhera non-dipping area were completed on May 1st, 1948.

Chipinga-Melsetter Veterinary District. No further extensions of the disease reported.

Umtali Veterinary District. An extension of the disease occurred to Zimunya Reserve on May 4th, 1948, and to Mt. Zinowi farm on May 21st, 1948.

Zimunya Reserve cattle were inoculated on May 7th, 1948, and Mt. Zinowi cattle on May 23rd, 1948.

By the end of May all animals in infected herds had contracted the disease.

Mallein Testing. Forty-three horses were tested with negative results.

Tuberculin Testing. Thirty bulls, 13 cows, 66 heifers and nine yearlings were tested with negative results.

IMPORTATIONS.

Union of South Africa: Bulls (breeding) 29, cows and calves (breeding) 88, geldings 44, horses and mares 6, sheep (slaughter) 150.

Bechuanaland Protectorate: Oxen (slaughter) 1,395, cows (slaughter) 320, bulls (slaughter) 66, sheep (slaughter) 124.

Northern Rhodesia: Geldings 2, horses and mares 3.

EXPORTATIONS.

Northern Rhodesia: Pigs (breeding) 4, bulls (breeding) 7, mules 44.

Portuguese East Africa: Pigs (breeding) 2, oxen (slaughter) 67, donkeys 16.

Belgian Congo: Horses and mares 1, geldings 1.

EXPORTATIONS—MISCELLANEOUS.

In Cold Storage.

Union of South Africa: Offal 13,884 lbs., dripping 15,975 lbs., sausage casings 9,983 lbs.

United Kingdom: Poultry 12,001 lbs.

Belgian Congo: Goat meat 3,082 lbs., offal 14,921 lbs., beef 217,286 lbs., veal 115 lbs., mutton 118 lbs.

Bechuanaland Protectorate: Offal 416 lbs., beef 62 lbs., sausage 619 lbs., bacon 291 lbs., pork 161 lbs., brawn 31 lbs.

Northern Rhodesia: Offal 15,320 lbs., beef 245,783 lbs., veal 111 lbs., sausage, 5,930 lbs., dripping, 1,659 lbs., bacon 23,165 lbs., gammon 920 lbs., ham 48 lbs.

Meat Products from Liebig's (Rhodesia) Ltd., West Nicholson.

Union of South Africa: Ox bungs 550 lbs., beef middles 125 lbs., weasands 360 lbs.

J. S. ADAMSON,
Acting Director of Veterinary Services.

SOUTHERN RHODESIA
Locust Invasion, 1932-48

MONTHLY REPORT No. 188: JUNE, 1948.

Red Locusts: *Nomadacris septemfasciata Serv.*

No Red Locusts in any stage of development within the Colony were reported.

J. H. WHELLAN,
Acting Chief Entomologist.

Rhodesian Milk Records

OFFICIAL MILK RECORDS.

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner
Matopo Ruth ...	Red Poll	Mature	3961 50	163 56	4 13	130	Government Experiment Station, P.B. 19K, Bulawayo.
Matopo Sunbeam	Red Poll	Mature	6494 90	215 81	3 32	266	
Meadows Pioneer Daydream II. ...	Jersey	2 years	3923 00	216 92	5.53	246	J. H. Keightley, Moorfields, P.O. Glendale.
Fairseat Rose...	Jersey	2 years	4434 00	260 21	5.87	300	
Molly's Lady More of Wanganella	Guernsey	Mature	[illegible]77 50	204 99	4 64	300	E. J. Hards, Churchill Farm, P.B. Marandellas
Colonies Plaats Jeltje V ... Recalved 4/3/48	Friesland	Mature	4316 00	142 70	3 31	243	Meikles Trust & Invest Co., Ltd., Leachdale, Shangani.
Mitchlin Lily's Dimple.. ... ... Recalved 6/10/47	Friesland	2 years	7795 50	259 57	3.33	300	V. S. Mitchell, Springs Farm, Iron Mine Hill
Mitchlin Dignity B IV. ... ... Recalved 15/9/47	Friesland	Junior 3 year	9467 50	339.05	3.58	300	
Albertvale Andre Van N.6/333 ... Recalved 14/1/48	Friesland	Senior 4 year	5729 00	176 49	3.08	281	T. C. Pascoe, Box 1253, Crowborough Estate, Salisbury.
Whinburn Acorn .. Recalved 16/1/48	Friesland	Junior 3 year	9972 90	353 91	3.55	300	Major R. R. Sharp, Whinburn, Redbank, Bulawayo
Whinburn Alchemy Recalved 18/2/48	Friesland	Senior 3 year	8047 20	279 98	3 48	300	
Whinburn Balm ... Recalved 2/9/47	Friesland	Senior 4 year	7924 80	284 64	3 60	300	
Whinburn Bramble Recalved 6/1/48	Friesland	2 years	4544 30	182 17	4 01	300	
Whinburn Chat .. Recalved 26/9/47	Friesland	Senior 3 year	9107 40	348 81	3 83	300	

Whinburn Clove Recalved 10/9/47	Friesland	Mature	9308 90	373 91	3 81	300	Major R R Sharp Whinburn, Redbank, Bulawayo
Whinburn Drongo Recalved 5/1/48	Friesland	Senior 4 year	9973 90	292 28	[illegible]	300	
Whinburn Fandango .. .. Recalved 7/10/47	Friesland	Mature	9080 40	335.47	3 69	300	
Whinburn Fox Trot Recalved 12/8/47	Friesland	Mature	9991 50	375 54	3.79	300	
Whinburn Mazurka Recalved 9/12/47	Friesland	Mature	9451 50	335 42	3.69	300	
Whinburn Oriole Recalved Oct 1947	Friesland	Junior 4 year	10552 00	355 29	3.34	300	
Whinburn Reel Recalved 18/11/47	Friesland	Mature	6514 60	215 33	3 31	252	
Whinburn Tarantella .. .. .. Recalved 15/1/48	Friesland	Mature	9834 10	352.48	3 58	300	
Whinburn Thyme Recalved 15/1/48	Friesland	Senior 4 year	9504 90	324 70	3.38	300	

SEMI-OFFICIAL MILK RECORDS.

Janet ..	G. Friesland	Mature	7268 70	229 41	3 16	262	D A Allan, Pendennis, P.O Avondale, Salisbury
Longone	G. Friesland	Mature	9305 20	329 02	3 54	300	
Lucia .	G. Friesland	Mature	7048 10	245 60	3 48	300	
Zindoro	G Friesland	Mature	5637.90	232.77	4 13	236	
Boy	G Friesland	Mature	9484 20	334 73	3 53	300	
Bulawayo	G. Friesland	Mature	9439 10	329 60	3.49	300	
Dolly	G Friesland	Mature	6877 60	229 62	3 34	300	
Gallon	G Friesland	Mature	7221.10	269 40	3 73	300	
Kambusi	G Friesland	Mature	10295 10	351 76	3 42	300	
Ndatwi	G Friesland	Mature	8726 10	[illegible] 01	3 21	275	
Petrol	G Friesland	Mature	8357 40	263 35	3 15	300	
Rita	G Friesland	Mature	9738 00	355 91	3 65	300	
Sataan	G Friesland	Mature	9073 90	289 19	3 19	300	
Victoria	G Friesland	4 years	8927 30	[illegible] 60	3 54	294	
Bunty	G Friesland	3 years	8141 40	275 57	3 14	273	Mrs. M Allan Pendennis, P.O Avondale, Salisbury
Diana	G. Friesland	3 years	8237 10	327 59	3 93	300	
Gertie	G Friesland	3 years	6682 20	233 28	3 57	300	
Sweet	G Friesland	3 years	7368 30	259 95	3 52	300	
Sylvia	G. Friesland	3 years	6595 50	241 35	3.66	300	
Avondale	G. Friesland	3 years	8299 60	264 46	3 19	300	

SEMI-OFFICIAL.—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
Brownie	G. Friesland	3 years	74[illegible]	273.24	3.69	300	Mrs. M. Allan, Pendennis, P.O. Avondale
Chiwaka	G. Friesland ...	3 years	6465.50	239.33	3.70	300	
Gracie	G. Friesland	3 years	7120.50	226.20	3.18	300	
Macumbi	G. Friesland	3 years	7892.50	267.01	3.38	300	
Majena	G. Friesland ...	3 years	8025.60	276.26	3.44	300	
Monkey	G. Friesland ...	3 years	7363.70	264.77	3.60	300	
Susa	G. Friesland ...	2 years	9178.60	312.95	3.41	300	
Colleen	G. Friesland ...	Mature	6432.00	269.14	4.18	300	G. Anderson, Warrender, Box 8, Gwelo.
No. 32	G. Friesland ...	Mature	7381.00	252.99	3.43	300	
No. 36	G. Friesland ...	Mature	8079.00	275.44	3.41	300	
Kate	G. Friesland ..	4 years	7322.60	242.82	3.32	296	I. D. H. Anderson, Upcott Farm, P.O. Fort Victoria.
Mary	G. Friesland .	Mature	7518.40	295.76	3.93	279	
Blarney	G. Friesland ..	Mature	6941.00	227.68	3.28	300	R. A Ballantyne, Box 801, Salisbury.
Audrey	G. Friesland	Mature	6836.20	272.33	3.98	300	N. G. Barrett, Gavenny, Rusapi.
Chris	G. Friesland	Mature	5587.30	230.02	4.12	247	
Famous	G. Friesland ..	Mature	8903.00	302.44	3.40	273	
Joyce	G. Friesland	Mature	6076.40	246.46	4.05	300	
Mamie...	G. Friesland	4 years	6774.20	248.13	3.66	260	
Maureen	G. Friesland	4 years	6279.00	245.23	3.95	300	
Penny	G. Friesland . ..	3 years	5860.90	225.29	3.84	300	
Phyllis...	G. Friesland .	Mature	7733.90	253.45	3.27	300	
Diamond	G. Dairy Shorthor	Mature	4534.00	225.08	4.96	300	F. J. Barry, Box 209, Umtali.
Dolly	G. Shorthorn... ...	Mature	7534.00	277.32	3.68	300	
Naartje III....	G. Shorthorn...	Mature	5806.00	226.17	3.90	300	
Nellie	G. Shorthorn .. .	Mature	8509.00	325.17	3.82	300	
Very Nice II.	G. Afrikander .	Mature	5136.00	252.35	4.91	247	
Diana	G. Friesland ..	Mature	8754.20	301.92	3.45	300	
Mattie	G. Shorthorn .. .	Mature	9646.00	372.20	3.86	300	
Mina II.	G. Shorthorn...	4 years	6189.20	238.11	3.85	300	
Blue Six	G. Shorthorn. ..	Mature	6598.70	270.76	4.10	300	J. H. Barry, Box 209, Umtali.
Dairy II.	G. Shorthorn. .	Mature	6219.00	246.93	3.97	300	
Ouma II.	G. Shorthorn... .	4 years	6207.60	252.94	4.07	300	

Blossom	G. Shorthorn	Mature	5497.00	254.33	4.63	300	J. H. Barry, Box 209, Umtali.
Joy	G. Shorthorn	Mature	7021 50	256 76	3.66	300	
Mafuta II.	G. Shorthorn	Mature	5462.10	230.73	4.22	300	
Quizzie	G. Afrikander	Mature	4953.40	249 71	5.04	300	
Cat	G. Friesland	Mature	6392 50	228.48	3.58	300	J. A. Baxter, Glen Norah, Box 1363, Salisbury.
Convoy	G. Friesland	Mature	6621 80	226.46	3 42	330	
Gwen	G. Friesland	Mature	5507.70	259.48	4 71	300	
Life Buoy	G. Friesland	Mature	6490.50	239 55	3.69	281	
Rudolf	G. Friesland	Mature	7203 00	230.08	3.19	300	
Sunlay	G. Friesland	Mature	6662.20	226.73	3.40	300	
Vanguard	G. Friesland	Mature	6427.90	236.13	3.68	300	
Albert Vale Umpoekoe	P.B. Friesland	3 years	9459.00	304 87	3.22	300	
Charles Hixon	G. Friesland	Mature	6399 40	246 95	3.86	300	
Charlie Vee	G. Friesland	Mature	6939.40	278.09	4.01	279	
Chemite	G. Friesland	Mature	9382.30	360.11	3 84	300	
Dop	G. Friesland	Mature	6741.80	273.60	4.06	300	
Durban	G. Friesland	Mature	6621 80	239 52	3 62	300	
France	G. Friesland	Mature	7194 80	297.34	4 11	273	
Fire	G. Friesland	Mature	8478 40	293.28	3.46	300	
Ice Cream	G. Friesland	Mature	11320.20	360.74	3.19	300	
Jafa	G. Friesland	Mature	7374 30	257.78	3.50	300	
Mabel	G. Friesland	Mature	6698.30	256 35	3 83	300	
Soap	G. Friesland	Mature	5479.00	231 63	4 23	300	
Albert Vale Bontrok	P.B. Friesland	Mature	10564.70	373.74	3.54	330	A. L. Bickle, Box 595, Bulawayo.
Albert Vale Rosa	P.B. Friesland	Mature	14031.90	422 53	3 01	300	
D 110	G. Friesland	Mature	11183.90	440 24	3.94	280	
D 97	G. Friesland	Mature	7875.50	244.89	3.10	220	
D 133	G. Friesland	4 years	6988 40	228 43	3 27	295	
J 44	G. Friesland	Mature	8887 00	310 89	3.50	284	
J 61	G. Friesland	Mature	9954 30	322.14	3 24	300	
Punch	G. Friesland	Mature	8329.80	318.33	3.82	300	Mrs. M. Black, Burnside Farm, P O Bindura.
Laura	G. Friesland	Mature	6926 00	236.25	3.41	249	C Boyd Clark, Mount Zonga, Inyazura
No. 125	G. Friesland	Mature	8029 00	322.62	4 02	300	
No. 151	G. Friesland	Mature	7147 00	269 69	3 77	300	
No. 190	G. Friesland	Mature	6809 00	243 01	3 57	281	
No. 198	G. Friesland	Mature	7732.00	293 01	3 79	287	
No. 263	G. Friesland	4 years	7160 00	259 07	3 62	274	
Betty	G. Guernsey	4 years	5970.70	256 90	4 30	300	Miss N. Brereton, Coolmoreen, Gwelo.

SEMI-OFFICIAL—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B Fat in lbs	Average % B. Fat.	No. of Days.	Name and Address of Owner
Beverley	G. Friesland	4 years	6406 50	227 97	3.56	300	M. W. Burras, Hertford Farm, Bulawayo
Diamond	G. Friesland	Mature	11773.00	368 69	3.13	300	
Twinkle	G. Friesland	3 years	6746.00	246.05	3.65	270	E Butler, Woodlands, Shamva.
Margaret	G. Friesland	Mature	8522.30	256.46	3.01	300	D. L Cameron, Lochiel, Fort Victoria.
154 (Rose Mary)	G Red Poll	Mature	6290.40	228 32	3 63	300	
Janet	G. Ayrshire	3 years	6243.00	247.40	3.96	300	L. E. O. Cary, Clovelly, Trelawney.
Ruth	G. Ayrshire	2 years	7027.00	252 83	3.60	300	
Allanah	G. Ayrshire	Mature	6289.40	271 90	4 32	281	Est R. Jackson Clark, Kingston Farm, Gwelo.
Faith	G. Friesland	3 years	5861 70	228 37	3.18	300	
Hoppity	G. Friesland	Mature	7967.80	325.09	4 08	300	
Iris	G. Ayrshire	Mature	7058 30	261 47	3 70	300	
Kathleen	G. Friesland	Mature	8259.20	321.17	3.86	300	
Mary	G. Friesland	4 years	7149.50	250.79	3.51	277	
Norma	G. Friesland	4 years	6488 10	234.25	3.61	288	
Penny	G. Friesland	3 years	6939.20	244 40	3.53	300	
Sylvia	G. Friesland	Mature	8207 80	315.50	3.84	300	
Jessie	G. Friesland	Mature	6099 50	241.30	3.96	273	Mrs. M Coomer, Railway Farm No 1, Eiffel Flats.
Judy	G. Friesland	Mature	6631 60	253.35	3 82	286	
Sandra I.	G. Friesland	3 years	8344 40	293.46	3.52	300	Thos Cousins, Oaklands, P.B. Gwelo.
Maria Hillside	G. Friesland	Mature	6618 00	232 59	3.51	300	J. Cumming Hillside Farm, Norton.
Stable	G. Friesland	Mature	6478 00	250.10	3.86	300	
Rusapi I.	G. Friesland	Mature	6289.00	234 81	3 73	300	
Seriman II. Hillside	G. Friesland	4 years	7593.00	260 92	3 44	300	
Stompie	G. Friesland	Mature	8812.90	337 76	3.83	300	Daisyfield Orphanage, P.B. 151Q, Bulawayo.
Ophelia	G. Friesland	Mature	10679 00	353.54	3 22	300	A. C de Olano, Blue Waters, Bromley.
Pillow II	G. Friesland	Mature	8041 00	272.72	3 39	300	
Stoport	G. Friesland	Mature	6322 00	227 82	3.60	300	A B. Dobson, Endeavour Farm, Norton

No. 112	G. Friesland	Mature	8049.50	287.25	3.59	300	J. B. Dold, Box 1153, Salisbury
No. 334	G. Common	Mature	6646.40	259.01	3.90	300	B. St. J. D. Downs, Sa'ago, Gwelo
No. 387	G. Guernsey	Mature	8366.60	297.50	3.69	300	
No. 403	G. Guernsey	Mature	5817.40	234.46	4.03	271	
No. 425	G. Guernsey	Mature	9485.70	358.85	3.78	300	
No. 487	G. Guernsey	23 months	5449.20	232.63	4.27	300	
No. 492	G. Guernsey	22 months	6035.40	236.23	3.91	300	
Judy	G. Friesland	4 years	6760.40	228.80	3.38	300	J. C. Edwards, Box 11, Eiffel Flats
Sinyati	G. Friesland	Mature	7561.00	245.02	3.24	253	
Umswesw[illegible]	G. Friesland	Mature	6201.20	233.68	3.77	269	
Dirko Dinsdag	P.B. Friesland	Mature	6986.00	271.11	3.88	236	Mrs. M. Everard, Castle Zonga, Inyazura.
Zonga Gillian	P.B. Friesland	3 years	6850.00	263.02	3.84	260	
No. 164	G. Friesland	Mature	6818.00	277.82	4.07	270	
No. 176	G. Friesland	Mature	7629.00	273.67	3.59	272	
No. 222	G. Friesland	Mature	7160.00	266.55	3.72	248	
No. 243	G. Friesland	Mature	5851.00	235.39	4.02	300	
No. 313	G. Friesland	3 years	6612.00	230.19	3.48	269	
No. 33	G. Friesland	Mature	7223.50	297.89	4.11	288	H. C. Fischer, Olivia Farm, Headlands
No. 59	G. Friesland	4 years	7923.00	282.23	3.56	256	
No. 60	G. Friesland	Mature	7397.00	273.11	3.69	300	
No. 76	G. Friesland	4 years	6823.00	254.34	3.73	300	
No. 246	G. Friesland	Mature	7417.00	270.43	3.65	248	
No. 282	G. Friesland	Mature	6604.00	241.85	3.66	244	
No. 10	G. Friesland	Mature	10584.00	337.62	3.19	300	R. Le S. Fischer, Wakefield, Headlands
No. 26	G. Friesland	Mature	12875.00	391.15	3.04	300	
No. 50	G. Friesland	Mature	10954.00	340.40	3.11	300	
No. 59	G. Friesland	Mature	12719.00	430.23	3.38	300	
No. 89	G. Friesland	4 years	6930.00	262.18	4.23	300	
No. 117	G. Friesland	4 years	12213.00	477.54	3.91	300	
No. 215	G. Friesland	2 years	8153.00	344.01	4.22	300	
No. 218	G. Friesland	2 years	6708.00	270.30	4.03	282	
No. 219	G. Friesland	2 years	7630.00	276.99	3.63	300	
No. 395	G. Friesland	Mature	9801.00	442.15	4.51	300	W. F. Fischer, Coldstream Dairy, Headlands.
No. 399	G. Friesland	Mature	7512.00	289.53	3.85	300	
No. 443	G. Friesland	Mature	5735.00	235.88	4.11	300	
No. 453	G. Friesland	Mature	7499.00	290.24	3.87	300	
No. 459	G. Friesland	Mature	6336.00	256.42	4.05	271	
No. 497	G. Friesland	4 years	6564.00	256.74	3.91	272	
No. 490	G. Friesland	Mature	7586.00	288.10	3.80	255	
No. 503	G. Friesland	4 years	6201.00	230.44	3.72	280	

SEMI-OFFICIAL—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
No. 514	G. Friesland	3 years	5488.00	230.91	4.21	292	W. F. Fischer, Coldstream Dairy, Headlands.
No. 535	G. Friesland	3 years	6946.00	296.03	4.26	275	
Gilston Esme	P.B. Red Poll	Mature	6397.00	274.59	4.29	300	G. N. Fleming, Box 688, Salisbury.
Amanda	G. Friesland	2 years	10054.00	449 82	4.47	300	F. W. Forrester, Wilton, P.O. Marandellas.
Blackberry	G. Friesland	4 years	8159.00	324.01	3.97	300	
Baller	G. Friesland	3 years	5516.50	281 11	5.09	300	G. J. Franklin & Son, Box 105, Umtali.
Chidakwa	G. Friesland	Mature	8765.50	327 68	3.74	300	
Compound	G. Friesland	Mature	7933.30	309 49	3.90	300	
Jam	G. Friesland	Mature	11449.90	457.38	3.99	300	
Kudada	G. Friesland	Mature	6073.40	244.92	4.03	293	
Linda	G. Friesland	4 years	4887.70	252.02	5.16	245	
Sandy	G. Friesland	Mature	7823.90	292.95	3.74	300	
Snake	G. Friesland	Mature	5872.40	258.44	4.40	290	
Spitfire	G. Friesland	Mature	10424 60	388.61	3.73	300	
Reinsbok	G. Friesland	Mature	5167.40	230.09	4.45	253	
Bembesi	G. Friesland	Mature	8779.20	292.49	3.22	300	P. Freeland, Langfield, Gwelo.
Carnation	G. Friesland	Mature	7817.30	293.14	3.75	300	
Maglass	G. Friesland	4 years	7353.70	271.92	3.70	288	
Munga	G. Friesland	3 years	7076 50	265.01	3.74	300	
Peach	G. Friesland	Mature	7316.60	257.68	3.52	300	
Salisbury	G. Friesland	Mature	8680 30	320.86	3.70	300	
No. A. 41	G. Friesland	Mature	7522 80	251.74	3 35	300	
No. 53	G. Friesland	Mature	9590.00	308.50	3 22	300	
No. 422	G. Guernsey	4 years	6267.80	242.24	3.86	300	
Annabelle	G. Guernsey	4 years	5691 60	249.35	4.38	300	G. G. Futter, Majoribanks, Gwelo.
Satan	G. Friesland	4 years	5320 10	230.30	4.33	300	
No. 167	G. Friesland	4 years	5836 00	240.11	4.11	291	W. N. Gebbie, P.B. 19A, Salisbury.
No. 131	G. Friesland	Mature	5635 60	257 06	4.41	259	
No. 138	G. Friesland	Mature	6111.20	233.04	3.81	300	
Hope	G. Friesland	Mature	7427 00	252 03	3.39	300	Hon. H. V. Gibbs, Bonisa, Redbank, P.B. 52L, Bulawayo.
Lizzie	G. Friesland	Mature	8940.00	288.89	3.23	300	
Lynn	G. Friesland	Mature	8366 00	264 10	3 16	300	

Mary	G. Friesland	4 years	7304 00	261 27	3.58	300	Hon H. V. Gibbs, Bonisa, Red Bank, P B 52L, Bulawayo.
Ursula	G. Friesland	Mature	8726 00	268 71	3.19	300	
Venus	G. Friesland	Mature	8416.00	214 75	3.74	279	
No. 143	G. Red Poll	Mature	8129 60	292.44	3.60	196	Govt. Experiment Station, P.B. 19K, Bulawayo.
No. 179	G. Red Poll	Mature	9418 90	328.30	3.49	300	
No. 137	G. Red Poll	Mature	7735.70	247.60	3.20	300	
Lysander (11)	G. Friesland	Mature	7940 00	278 28	3.51	286	Govt Farm, Gwebi, P.B 76B, Salisbury.
Mosquito (5)	G. Friesland	Mature	6648.50	248.08	3.73	265	
Seafire (19)	G. Friesland	Mature	8509.50	277.80	3.26	300	
Nora	G. Friesland	4 years	10276.40	330.50	3.22	295	Govt Farm, Umshandige, Ft. Victoria.
No. 28	G. Friesland	Mature	12337 20	403.49	3.27	300	Grasslands Experiment Station, Marandnellas.
No. 49	G. Friesland	4 years	12136 80	428.94	3.53	300	
No. 16	G Friesland	Mature	6691 10	246.51	3 68	300	R. H. Greaves, Fountain, Nyamandhlovu.
Emu	G Friesland	2 years	7597.90	269 64	3.55	300	E E C. Green, Box 879, Bulawayo.
Joy	G. Friesland	Mature	7377.90	278.11	3.77	278	
Dolly	G. Guernsey	Mature	6395.90	276.28	4.32	300	D A. Harley, Harleyton, P O. Beatrice
Jill	G. Guernsey	Mature	6356 00	268.01	4.22	300	
June	G. Guernsey	Mature	6974 60	261.10	3.74	300	
Lena	G Friesland	Mature	8063 10	264 70	3.28	300	
Magda	G. Guernsey	Mature	6174.60	240 49	3 89	300	
Maud	G. Guernsey	Mature	6237 50	265.82	4.26	300	
Mona	G. Guernsey	Mature	5712.00	238 87	4 18	275	
Queenie II	G. Guernsey	Mature	6844 80	283.61	4.14	297	
Bridget	G Guernsey	Mature	7765 90	309.96	3.88	300	
Ida	G Guernsey	Mature	6133 30	262 42	4 28	300	
Jenny	G Guernsey	3 years	5840.20	255 56	4 38	300	
Myrtle II	G Guernsey	Mature	5749 60	248 59	4 32	300	
Paddy	G. Guernsey	Mature	6091 20	235.79	3 87	300	
Pauline	G. Guernsey	Mature	7691 80	285 24	3 71	300	
Petal	G. Guernsey	Mature	5703 60	247 84	4 35	300	
Rita II.	G. Guernsey	Mature	6669 50	249 49	3 73	300	
Sarah	G Guernsey	Mature	6859 20	256.06	3.88	300	
Mabenya	G. Friesland	Mature	5256 00	289.57	5.51	211	H. C. Harrold, Steynstroom West, Cashel
Fussy ...	G L.R. Shorthorn	Mature	7312 90	227.92	3.12	300	D. J. Huddy Box 718, Salisbury.
Petal	G. Friesland	Mature	9496 50	330.93	3.48	300	
Rosemary ...	G Friesland	Mature	7234 50	295 42	4 08	252	
Susan	G Friesland	Mature	6945 70	256 62	3.69	268	

SEMI-OFFICIAL—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days	Name and Address of Owner.
Whisky	G. Friesland	Mature	7706.50	294.44	3.82	240	D. J. Huddy, Box 718, Salisbury.
Donkey	G. Friesland	Mature	8678.70	282.58	3.26	300	
Molly	G. Friesland	Mature	6741.90	226.86	3.36	300	
Nancy	G. Friesland	Mature	8511.50	283.87	3.34	300	
Daisy	G. Guernsey	Mature	7982.90	296 36	3.71	330	L. Huddy, Box 924, Salisbury.
Isis	G. Friesland	Mature	6798.60	245 22	3.61	300	
Blom III.	G. Friesland	4 years	6680.20	285.22	4.27	300	
Chipinga	G. Friesland	Mature	6797.60	236.69	3.48	293	
Grace	G. Friesland	Mature	7544.60	284.89	3.78	300	
Joyce	G. Friesland	Mature	6270.80	251.74	4.01	300	
Limbe	G. Friesland	Mature	7605.10	264 44	3.24	247	
Mablos	G. Friesland	Mature	5987.70	251 11	3.59	280	
Elsie	G. Guernsey	4 years	5613.00	238 67	4 25	300	Mrs M. R. Huddy, Box 899, Salisbury.
Jessie	G. Friesland	Mature	6312.00	262.06	4 15	300	
Polly	G. Friesland	Mature	7216.60	245 67	3.40	300	Sir G. M. Huggins, Box 671, Salisbury.
Bloom	G. Red Poll	Mature	4808.80	242.69	5.05	284	A. Patton Jamieson, Dunsappie, Theydon.
No. 11	G. Friesland	Mature	9010.00	349 60	3.88	300	D S. Kabot, Box 261, Bulawayo.
No. 27	G. Friesland	Mature	11732.00	522 80	4 46	300	
No. 55	G. Friesland	Mature	10666.00	378.95	3.55	300	
K. 2	G. Friesland	Mature	7594 10	318.49	4.19	264	B. H. Kew, Cranmore, Box 972, Bulawayo.
K. 13	G. Friesland	Mature	6141.50	225.27	3.67	300	
Ann	G. Friesland	Mature	9323.00	335.93	3.60	300	D. King Rockwood Farm, P.O. Concession.
Maryrose	G. Friesland	Mature	6804 00	260.06	3.82	263	
Sally II.	G. Friesland	Mature	9990.70	374 19	3.75	300	
Tib	G. Friesland	Mature	7378 50	241.21	3.27	300	
Cherry	G. Jersey	3 years	8083 49	408.17	5 04	300	E. M. Kok, Everton Farm, P O. Inyazura.
Piccanin II.	G. Jersey	2 years	7564 70	340.15	4.36	294	
Polly II.	G. Jersey	3 years	5464 50	242 60	4.44	300	
Annie	G. Friesland	Mature	5932 20	235 41	3.93	300	Mrs. M. M. Krahner, Haydock Park, Banket.
Pumpkin	G. Friesland	Mature	7565.60	261 76	3.46	300	

No. 16	G. Shorthorn	Mature	6754.30	276.53	4.09	300	H. T. Lay, P B 107C, Salisbury.
No. 7	G. Friesland	Mature	7065.00	251.46	3.56	300	
No. 17	G. Shorthorn	Mature	6527.00	249.35	3.82	300	
No. 25	G Friesland	Mature	7075.50	268.69	3.80	300	
No. 28	G Friesland	4 years	5144.50	264.27	4.30	300	
No. 34	G Friesland	3 years	7090.30	270.79	3.82	300	
Ardbennie I.	G. Friesland	Mature	6633.20	274.92	4.14	300	P. Linton, Box 898, Salisbury.
Hat	G. Friesland	Mature	8262.70	339.21	4.14	300	
January II.	G Friesland	Mature	5994.70	234.43	3.91	300	
Machlangwanda II.	G Friesland	Mature	9643.90	365.75	3.79	300	
Madani II.	G. Friesland	Mature	6922.70	253.52	3.66	300	
Magwagwa I.	G. Friesland	Mature	8462.40	324.83	3.84	300	
Mahuli II	G. Friesland	Mature	7449.00	242.84	3.26	259	
Mary II.	G. Friesland	Mature	7862.50	287.22	3.65	300	
Mtero II.	G. Friesland	Mature	6755.40	255.73	3.79	300	
Nesta II	G. Friesland	Mature	6669.30	263.09	3.93	300	
Dixie	G Friesland	Mature	7529.00	243.48	3.23	300	J. MacIntyre, Box 58, Shamva
Kitty	G Friesland	Mature	6655.60	278.60	4.19	300	C. J. Marshall, Box 654, Bulawayo
No. 10	G Friesland	Mature	6691.20	268.09	4.00	300	D. W. Marshall, Alderberry, Box 164, Umtali
No. 39	G Friesland	Mature	6907.80	225.18	3.73	300	J. U McCay, P.B. J181, Bulawayo.
No. 41	G Friesland	Mature	9123.30	340.49	3.73	300	
No. 104	G. Friesland	Mature	7635.80	233.46	3.06	300	
No. 3	G Friesland	Mature	6585.00	233.64	3.55	300	J. H. McLean, Divide, Box 161, Gwelo.
Jersey	G. Jersey	Mature	6744.40	271.62	4.03	300	
Kempie	G. Friesland	Mature	5604.10	257.51	4.60	300	
Spuds	G Friesland	Mature	6848.20	316.49	4.62	300	
Verand	G Friesland	Mature	6792.90	273.93	4.03	300	
White	G Friesland	Mature	5816.78	228.49	3.93	300	
Elizabeth (5)	G Friesland	Mature	8699.90	313.07	3.60	300	L. McLean, Divide, Box 161, Gwelo.
Bless No 7	G Friesland	Mature	7318.80	285.53	3.90	300	
P 8/3	P.B. Friesland	3 years	6892.00	247.88	3.60	300	Meikles Trust & Invest Co., Ltd., Leachdale, Shangani
P 9/3	P.B. Friesland	4 years	6923.00	250.48	3.62	300	
G 3/0	G Friesland	Mature	10936.00	386.95	3.54	300	
G 14/1	G. Friesland	Mature	6584.00	231.87	3.52	300	
G 15/3	G Friesland	3 years	6113.00	265.26	4.34	300	
G 24/3	G Friesland	3 years	7364.00	295.57	4.01	300	
6/9	G Friesland	Mature	8428.00	257.18	3.05	252	
G 19/9	G Friesland	Mature	6481.00	239.70	3.70	295	
24/9	G Friesland	Mature	8030.00	294.83	3.67	269	

OFFICIAL. COMPLETED LACTATION.

Name of Cow	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of days	Name and Address of Owner
P 1/9	P.B. Friesland	Mature	10903.00	353.84	3.25	300	Meikles Trust & Invest. Co., Ltd., Leachdale, Shangani.
G 13/8	P.B. Friesland	Mature	9200.00	278.23	3.02	300	
G 56/5	P.B. Friesland	3 years	8420.00	293.07	3.48	300	
Ten Ten	G. Friesland	Mature	5331.50	228.36	4.28	300	Misses I. and J. Mitchell, Argyll, P.O. Odzi.
Norah	G. Friesland	Mature	5590.00	231.51	4.14	300	
Monzeli II.	G. Friesland	Mature	6995.10	225.51	3.22	282	S. Moore, Box 999, Salisbury.
Soap	G. Friesland	Mature	7386.30	262.39	3.55	300	
Tommy II.	G. Friesland	Mature	6267.60	240.79	3.84	300	
Isnati	G. Friesland	Mature	6910.00	262.00	3.79	300	Commender E. L. Morant, Box 741, Salisbury.
Marigold	G. Ayrshire	Mature	5955.70	243.36	4.09	300	
Mrewa	G. Friesland	Mature	5460.60	228.09	4.14	300	
Nyabira	G. Friesland	Mature	6634.40	250.93	3.78	300	
Phyllida	G. Ayrshire	Mature	6286.30	235.33	3.74	300	
Reuter	G. Friesland	Mature	5680.30	228.54	4.02	300	
Ukato	G. Ayrshire	3 years	5623.20	228.03	4.06	300	
Doris	G. Friesland	Mature	7689.20	303.94	3.95	300	
Quality	G. Ayrshire	Mature	6490.40	299.65	4.62	300	
Napoli	G. Friesland	2 years	7749.00	268.09	3.46	300	G. R. Morris, Box 1040, Salisbury.
No. 60	G. Friesland	Mature	11159.00	347.56	3.11	300	F. B. Morrisby, Sunnyside, Box 36, Gwelo.
No. 65	G. Friesland	Mature	6445.00	228.69	3.54	300	
No. 71	G. Friesland	Mature	9217.00	277.25	3.00	300	
No. 141	G. Friesland	Mature	7299.00	245.71	3.36	330	
Peggy	G. Friesland	Mature	5447.60	250.74	4.60	279	J. T. Mungle, Myreside, Odzi.
Zimunga	G. Friesland	Mature	6437.20	252.51	3.92	300	
Grace	G. Friesland	3 years	7503.60	312.74	4.17	300	
Exwell Lindfast Denise	P.B. Friesland	3 years	6058.00	243.96	4.03	300	K. Norvall, Box 637, Bulawayo.
Greece	G. Red Poll	Mature	7273.00	256.19	3.52	300	
Numnet	G. Friesland	Mature	8158.00	255.24	3.13	300	
Babs	G. Friesland	Mature	8560.70	308.85	3.61	300	E. Palmer, Ferndale, Penhalonga.
Delia	G. Friesland	Mature	6038.60	250.98	4.16	262	
Helen	G. Friesland	Mature	8026.90	315.30	3.93	300	

Jane	G. Friesland	Mature	6693.20	280.08	4.18	294	E. Palmer, Ferndale, Penhalonga.
Meg	G. Friesland	Mature	7205.40	394.52	4.23	300	
Simbob II.	G. Shorthorn	3 years	5525.30	232.63	4.03	281	
Topsy	G. Friesland	Mature	10660.20	344.38	3.23	300	
Edna	G. Friesland	Mature	8066.20	262.67	3.26	269	
Babs	G. Friesland	4 years	8522.00	262.47	3.06	300	Mrs. M. Parsons, Box 7, Bulawayo.
Petty	G. Friesland	2 years	8960.50	329.24	3.67	300	
Blume	G. Friesland	Mature	8126.50	301.43	3.71	300	
Connie	G. Friesland	4 years	11361.50	380.35	3.35	300	
Daisy	G. Friesland	4 years	9176.00	317.52	3.46	300	
Dessie	G. Friesland	3 years	10594.00	346.17	3.27	300	
Eveline	G. Friesland	4 years	7564.00	287.56	3.80	300	
Glenville	G. Shorthorn	3 years	11216.00	379.74	3.39	300	
Jerry	G. Friesland	Mature	12450.00	398.31	3.20	300	
Matilda	G. Friesland	3 years	7950.50	298.56	3.76	300	
Mustard	G. Friesland	Mature	9072.50	290.36	3.20	300	
Nash	G. Friesland	Mature	10464.00	330.57	3.16	300	
Poonsie	G. Friesland	3 years	7037.00	244.67	3.48	300	
Spitzkop	G. Friesland	Mature	7087.50	262.95	3.71	300	
Volkop	G. Friesland	Mature	6220.00	263.24	4.23	300	
DI.	G. Friesland	Mature	6447.00	246.26	3.82	300	T. C. Pascoe, Crowborough Estate, Box 1253, Salisbury.
No. 6A	G. Friesland	4 years	7181.00	230.92	3.22	277	
No. 89B	G. Friesland	4 years	6198.00	238.94	3.86	300	
No. 34	G. Friesland	Mature	7671.50	250.16	3.26	300	
No. 41	G. Friesland	Mature	8309.00	262.73	3.16	300	
No. 44	G. Friesland	Mature	8279.50	295.32	3.57	300	
No. 58	G. Friesland	Mature	7553.50	264.86	3.51	300	
No. 67	G. Friesland	Mature	7341.00	248.91	3.39	266	
No. 87	G. Friesland	4 years	6866.50	231.57	3.37	300	
No. 117	G. Friesland	Mature	6842.50	246.61	3.60	300	
No. 118	G. Friesland	Mature	7030.00	261.88	3.73	300	
No. 146	G. Friesland	Mature	8448.50	286.92	3.40	300	
No. 180	G. Friesland	3 years	6847.10	266.08	3.89	300	
No. 199	G. Friesland	Mature	5710.00	237.95	4.17	300	
No. 50	G. Friesland	Mature	9328.50	305.22	3.27	250	
No. 2A	G. Friesland	3 years	6359.50	244.84	3.85	300	
Mimi	G. Friesland	Mature	7591.50	288.84	3.82	300	Red Valley Estate, Marandellas.
Jenny	G. Friesland	Mature	6111.00	228.74	3.74	300	Rhodesian Corporation Ltd., Kent Estate, Norton.
Julia	G. Friesland	Mature	5894.00	225.92	3.83	300	
Kerry	G. Ayrshire	Mature	5698.00	251.72	4.42	300	
Molly II.	G. Friesland	Mature	5577.00	237.52	4.26	300	
Nonsense	G. Friesland	4 years	6780.00	254.68	3.76	300	

SEMI-OFFICIAL.—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
Lam	G. Friesland	Mature	8144.70	324.27	3.98	300	Mrs. M. Rogers, Bickford, Gwelo.
No. 19 (Rebecca)	G. Friesland	Mature	7035.50	230.55	3.28	300	Mrs. D. H. Rutherford, Igava, Marandellas.
Rooi-Meis	G. Guernsey	Mature	7268.30	282.70	3.89	300	Salvation Army, Box 14, Salisbury.
Janet	G. Ayrshire	4 years	5826.60	229.52	3.94	300	
Paelo	G. Friesland	Mature	8324.30	281.51	3.38	300	W. F H. Scutt, Maple Leafe, Norton.
Wezulu	G. Common	2 years	4954.40	233.93	4.72	300	
Dikison	G. Friesland	Mature	6160.40	252.90	4.11	300	
Wankis	G. Friesland	Mature	7503.30	249.42	3.33	300	
Wilson	G. Friesland	Mature	7646.10	281.70	3.68	300	
Machara I.	G. Friesland	Mature	5555.00	229.26	4.13	300	E. Stanger, Chimbi Source, Rusapi.
Barbara	G. Friesland	2 years	6826.50	227.06	3.33	300	Mrs. V. Stead, Box 56, Gwelo.
Florrie	G. Friesland	Mature	7748.00	279.95	3.61	300	
Marie	G. Ayrshire	Mature	7328.00	314.13	4.29	300	
Star	G. Friesland	Mature	5534.50	228.63	4.13	228	
G. 2	G. Ayrshire	Mature	7046.00	271.03	3.85	300	J. R. Stewart & Sons, Ltd., Battle Farm, P.O. Shangani.
G. 6	G. Ayrshire	Mature	5703.00	232.00	4.07	300	
No. 10 (G)	G. Ayrshire	Mature	7437.00	261.31	3.54	273	
G. 13	G. Ayrshire	Mature	6391.00	255.77	4.00	300	
G. 15	G. Ayrshire	Mature	8281.00	297.75	3.60	300	
G. 19	G. Shorthorn	4 years	6847.00	277.68	4.06	300	
G. 20	G. Ayrshire	4 years	7545.00	304.67	4.04	284	
P. 20 Battle Penrose I.	P.B. Ayrshire	Mature	7044.00	295.03	4.19	274	
P. 25	P.B. Ayrshire	4 years	7825.00	294.00	3.76	300	
Battle Elsie III.	P.B. Ayrshire	Mature	8246.00	314.95	3.82	280	
Battle Fairy I.	P.B. Ayrshire	4 years	8790.00	369.12	4.20	300	
Battle Fairy IV.	P.B. Ayrshire	4 years	6416.00	246.49	3.84	300	
Battle Rose II.	P.B. Ayrshire	Mature	9713.00	321.78	3.31	300	
Jessie	G. Friesland	Mature	6598.00	234.84	3.56	300	Susman & Newfield Box 959, Salisbury.
Stella	G. Ayrshire	Mature	7460.00	231.99	3.11	300	
Tess	G. Friesland	4 years	7284.00	230.31	3.16	300	
Tilly	G. Friesland	4 years	7175.00	241.80	3.37	300	
No. 69	G. Friesland	4 years	7434.00	228.34	3.07	300	

Guinea Fowl	G. Friesland	3 years	6290.80	240.83	3.83	300	H. Swaine, Box 131, Gwelo.
Milk	G. Friesland	4 years	7074.40	233.45	3.30	300	
Nemo	G. Friesland	3 years	7062.50	233.54	3.31	300	
No. 3's Daughter	G. Friesland	Mature	8353.30	278.18	3.33	300	
Salisbury	G. Friesland	Mature	7241.20	274.83	3.80	287	
Africa	G. Ayrshire	21 months	5279.00	233.35	4.42	300	Evelyn Tapson Trust Ltd., Lesape Falls, Rusapi.
Black	G. Friesland	3 years	7747.00	284.97	3.68	300	
Debula	G. Friesland	Mature	6357.00	232.48	3.66	234	
Mabottle	G. Friesland	22 months	7126.00	246.61	3.46	281	
Majambe	G. Ayrshire	Mature	7158.00	275.44	3.85	300	
Mary II.	G. Friesland	19 months	7514.00	264.09	3.51	300	
Munyengwa.	G. Friesland	2 years	6297.00	225.52	3.58	300	
Watsonia.	G. Friesland	4 years	6110.00	244.05	3.99	300	
Apanamoney	G. Friesland	Mature	8259.00	305.07	3.69	279	
Beauty II	G. Friesland	2 years	5818.00	250.19	4.30	299	
Blanket III.	G. Ayrshire	Mature	7762.00	274.79	3.54	300	
Buhera	G. Friesland	Mature	7304.00	290.52	3.98	292	
Button	G. Friesland	4 years	8896.00	314.62	3.54	300	
Cecilia	G. Friesland	3 years	5820.00	235.17	4.04	300	
Chichaka	G. Friesland	Mature	8407.00	249.32	3.10	271	
Chineya	G. Friesland	4 years	6011.00	245.75	4.09	277	
Esnight	G. Friesland	3 years	6584.00	239.92	3.64	276	
Gunlever.	G. Friesland	3 years	5939.00	234.13	3.94	278	
Headlands	G. Friesland	4 years	7503.00	272.83	3.64	244	
Hinduska	G. Friesland	Mature	5439.00	232.87	4.28	199	
Janette	G. Friesland	Mature	6520.00	229.76	3.52	250	
Maggie	G. Friesland	Mature	7969.00	278.97	3.50	269	
Matensen III.	G. Friesland	4 years	7208.00	249.20	3.46	300	
Mayene	G. Ayrshire	Mature	6066.00	234.45	3.86	263	
Miriam II.	G. Friesland	4 years	8469.00	337.39	3.98	300	
Pumpkin	G. Ayrshire	Mature	6318.00	262.50	4.15	284	
Rhoda	G. Red Poll	Mature	6085.00	260.79	4.29	256	
Rosa	G. Friesland	Mature	7620.00	269.35	3.53	252	
Rose	G. Friesland	Mature	10334.00	359.27	3.48	300	
Rusapi III.	G. Ayrshire	Mature	6696.00	279.68	4.18	230	
Sinoia	G. Friesland	Mature	5317.00	231.12	4.35	240	
Tshabani	G. Friesland	Mature	8837.00	318.69	3.61	254	
Umtali	G. Friesland	4 years	5611.00	233.91	4.17	268	
Victoria	G. Friesland	4 years	6877.00	285.36	4.15	279	
Jessie	G. Friesland	Mature	6534.40	235.94	3.61	277	Est. late Mrs J. G. Taylor, Box 55, Selukwe.
Nellie	G. Friesland	Mature	7525.40	242.48	3.22	300	
Three Number.	G. Friesland	Mature	7269.10	237.20	3.26	300	

SEMI-OFFICIAL.—(Continued).

Name of Cow.	Breed	Age.	Milk in lbs	B. Fat in lbs.	Average % B. Fat.	No. of days.	Name and Address of Owner.
Betty	G. Friesland	Mature	6326 90	234.84	3 71	300	A. W Tennent, Kelvin, Headlands.
Gertie	G Friesland	Mature	6515 90	248.81	3 82	300	
Salisbury	G. Friesland	Mature	6848.80	236 65	3 46	300	
Norton	G. Red Poll	Mature	6228 30	239 41	3 84	300	J. G. Thurlow, Atherstone, Bindura.
Woodbrook	G Red Poll	Mature	4657 20	228.83	4 91	300	
Norta II.	G Red Poll	Mature	6565 30	259.49	3 95	300	
Petrol I.	G Friesland	Mature	6393.80	266 46	4 17	283	R Thwaites, Stow, Marandellas
Nurse	G. Friesland	Mature	6279 00	237 21	3.78	280	P S Timms, "Chitora," Rusapi.
Spotty	G. Friesland	Mature	5934 00	233 11	3 92	287	
Emerald	G Friesland	Mature	8315 70	263 87	3 17	300	C G Tracey, Handley Cross, P.B Gatooma.
Malvina	G. Friesland	Mature	8014 20	242.48	3 03	300	
Redleaf Beam V.9	P.B. Red Poll	Mature	5778 00	241.51	4 18	300	A M Tredgold, P.B. 61L, Bulawayo.
L 13	G. Red Poll	Mature	7264 00	275.33	3 80	300	
No. 127.	G Red Poll	Mature	6140 00	262.26	4 27	300	
No. 157.	G Red Poll	Mature	6698 50	244 28	3 65	300	
Verna	G. Friesland	Mature	8503.00	297 82	3 50	300	Miss I van Niekerk, Claremont, Inyanga, P.B. Rusapi.
Elysoun II.	G. Friesland	3 years	8754 00	265.29	3 04	300	R Waldschuts, Mere Farm, Box 27, Marandellas.
Mere Poppy	G. Friesland	Mature	7635.00	252 74	3 31	290	

THE RHODESIA

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Editorial

Notes and Comments

Agricultural Conferences in London

Three conferences of interest and value to Commonwealth agriculture were held recently in London, and were attended by official delegates from Southern Rhodesia. The first two were periodical conferences held within the framework of the Commonwealth Agricultural Bureaux—namely, the Fourth Commonwealth Mycological Conference, held from 19th to 24th July, and the Fifth Commonwealth Entomological Conference, held from 22nd to 30th July. The third was the African Phytosanitary Conference, held from 2nd to 5th August, and was international in character.

COMMONWEALTH MYCOLOGICAL CONFERENCE.

The Commonwealth Mycological Conference was attended by the Chief Botanist and Plant Pathologist, Dr. J. C. F. Hopkins. Among the Commonwealth Mycological Institute's business and routine affairs on which recommendations were made were the publication of handbooks on tropical and sub-tropical diseases of plants and monographs on fungi; microfilm reproduction of rare works; maintenance of the National Culture Collection of Fungi for distribution and accurate identification of species; and the inadequacy of accommodation at the Institute. Further recommendations of the Conference included support for the proposed African Phytosanitary Convention and the form this might take; precautions by rubber-producing countries against the importation of the deadly South American Leaf Disease; seed quality and testing; fungi affecting foodstuffs; the issue by the Institute of a broadsheet on appropriate technical matters of interest: and

the provision of free time in the future conferences to allow for informal meetings.

Other subjects discussed included the control of certain virus diseases; the diagnosis of nutritional disorders in plants; a Commonwealth list of common tropical plant diseases; the certification, use, and further development of fungicides; the biological control of insects and weeds; forest pathology; and (jointly with the Commonwealth Entomological Conference) the application of insecticides and fungicides from the air and recent developments in pest and disease control equipmet.

COMMONWEALTH ENTOMOLOGICAL CONFERENCE.

The Fifth Commonwealth Entomological Conference was attended by the Chief Entomologist, Mr. M. C. Mossop. Matters which formed the bases of resolutions or recommendations included the domestic affairs of the Commonwealth Entomological Institute such as improved facilities for the publication of results of research in economic entomology; identification of insects; the availability and interchange of information on economic entomology; the question of biological control of insects and weeds; the acute accommodation problems with which the Institute is faced; the value of the reviews of work submitted by different countries to the Conference; and the provision of staff for a comprehensive field study of termites. Further recommendations included the adoption of agreed common names in English for insecticides and suggestions for bringing this about, including the suggestion that others might apply the same policy to fungicides, herbicides, rodenticides, etc.; support for the proposed African Phytosanitary Convention with appropriate suggestions; the danger of the dissemination of insect pests by aircraft; progress in stored products entomology; and the provision of more time for informal discussions in future conferences.

Other subjects discussed on a general basis included the development, methods of application, and limitations of modern insecticides; locusts and grasshoppers; tsetse fly research and reclamation; and (jointly with the Commonwealth Mycological Conference) modern insecticides and their use and limitations, and machinery, including the use of aircraft.

AFRICAN PHYTOSANITARY CONFERENCE.

The African Phytosanitary Conference was attended by Mr. Mossop, whose representation embraced the Central African Territories. Representatives of most of the African Territories south of the Sahara were present. The first object of the conference was to decide whether it was desirable to establish a plant quarantine organisation on a continental basis in order to minimise the risk of importing dangerous insect pests and diseases into Africa. The matter had already been discussed by the immediately preceding Mycological and Entomological Conferences, and by the International Conference on Colonial Matters in Brussels in December, 1947, on the suggestion of which the present conference had been called. The recommendations of those three

conferences were of considerable assistance in the deliberations of the African Phytosanitary Conference.

Having agreed that it was desirable to establish an African Phytosanitary Convention in Africa south of the Sahara, the Conference drafted such a convention, which, if agreed to, will call upon each of the signatory powers to conform at least to a minimum limit of control of plant imports; to enact suitable legislation therefor; to subject plant imports to measures of quarantine, etc., agreed to by the majority; to exercise certain prohibitions; and to take local action to suppress major pests or diseases to be specified from time to time. Provision is made for official importation of small quantities of plants, etc., for scientific purposes. The draft convention included provision for the establishment of a permanent commission comprising one representative from each of the signatory powers (including Southern Rhodesia) to seek information and recommend action.

Vegetable Ivory Palm

Notes on the Collection of the Sap of the Vegetable Ivory Palm *(Hyphoene ventricosa)* and Manufacture of Palm Wine Spirit

(Information supplied by C. C. MEREDITH, Assistant Native Commissioner, Beitbridge.)

Collection. A palm tree is selected. A fire is then made about the base on ground for the purpose of burning away the dry and growing palm leaves surrounding the base. Hence the charred appearance of all dead palm trees.

The tapper then climbs the tree chopping notches alternately right and left for foot holds or steps (fig. 1) until he reaches the top. He then removes all palm leaves from the crown of the trunk, thus exposing the thimble-shaped end of the trunk. This thimble-shaped top measures from 6 to 12 inches in length, according to the size of the tree. It is soft and is the only part from which the sap is gathered. The tip of the thimble is then cut away. This cut must be made so as to form a slight depression across the section and sloping slightly downwards on one side in order that the liquid percolating through the top may flow towards the middle and then over the edge or side at the lowest point. A "V" shaped incision is then made in the thimble approximately 2 inches below this point (fig. 2), into which a section of petiole measuring about 2 inches in length is inserted to form a "V" shaped spout downwards cast (fig. 3). An ox horn or calabash is then secured immediately under this spout (fig. 3) and a plaited palm leaf hood (fig. 4) is placed over the top of the thimble. The purpose of this hood is to keep the end of the thimble moist and to prevent birds from settling on the exposed portion.

The horn or calabash receptacle contents are collected three times daily—at day-break, mid-day and late evening. The average receptacle holds from one to two pints.

It is important that on each and every visit a layer of approximately one-sixteenth of an inch must be cut from the top of the thimble. During the course of the period between visits the liquid tends to solidify and form a crust. This crust, together with the hardening end of the thimble, must be removed in order to allow free percolation and flow. It follows, therefore, that the spout must be shifted to a lower position from time to time as the thimble becomes shorter.

The period of collection depends on the depth of the thimble, for when hard wood is reached the palm can no longer be sapped. The normal period is from 20 to 30 days.

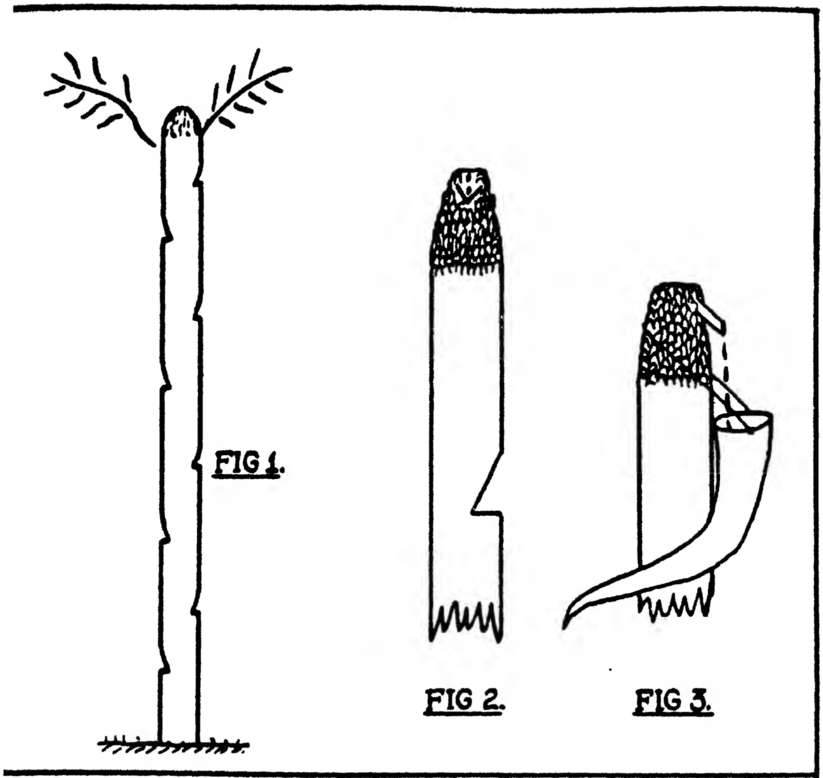


FIG 1.
FIG 2.
FIG 3.

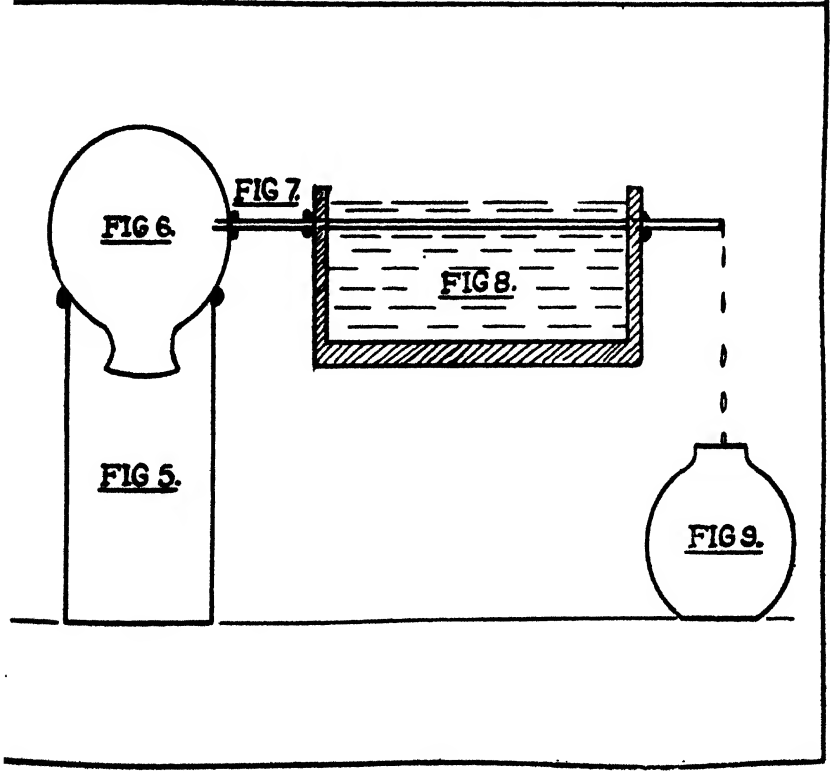


FIG 6.
FIG 7.
FIG 8.
FIG 5.
FIG 9.

The average palm yields about 15 gallons of palm wine.

The palm wine is consumed freely by men and women and in small quantities by the children. It is sweet and slightly intoxicating. I would describe it as being much like a good quality ginger beer with a suggestion of the flavour of hops. In colour it also resembles ginger beer—that is to say, it is slightly milky.

Very few of the tall or fully grown palms remain to-day,, the majority having been tapped. Young palms from two to six feet in height are now being tapped, and in some areas tapping is done below the surface level of the ground by digging down and exposing the young plant.

FIG 4.

Distillation. The sap or palm wine is distilled in a crude home-made still constructed as follows:—

A five or eight gallon metal drum is used as a boiler (fig. 5). An ordinary burnt clay native pot is fixed in an inverted position over the mouth of the drum and the joint sealed with wet clay in order to prevent the escape of vapour (fig. 6). A metal pipe (fig. 7) is then let into the side of the inverted pot and secured with clay. The metal pipe is then passed through the ends of a wooden trough fashioned from a tree trunk (fig. 8), which acts as a cooling bath or condenser when filled with cold water. Clay is again used to prevent leakage at the two holes in the trough ends through which the metal pipe passes.

Liquid sap previously placed in the drum is then brought to boiling point by means of a fire under the drum and the con-

densed vapour collected in a receptacle placed under the end of the metal pipe (fig. 8).

Five gallons of sap or wine yield approximately half-a-gallon of distilled spirit.

A sample of the distilled spirit was found to be inflammable, but not highly so.

The spirit is sold by the natives at an average price of 5s. per whisky bottle full.

The spirit is known as "Sikokiaan," a term or name now used by the natives for all home-distilled spirits whether from grain or fruit.

Poultry

The Management of Young Stock

By G. H. COOPER, Chief Poultry Officer.

At this time of year there are large numbers of young pullets and cockerels being reared on the farms and specialist poultry establishments. Many farmers get their pullets into lay too early, often at four and a half months, resulting in two months' production of unsaleable small eggs, or they underfeed, with the result the pullets are undersized and suffer from deficiencies. Management is therefore very important.

HATCHING SEASON.

The main hatching season is from May to September inclusive, because pullets hatched during this period should come into lay at the end of the year and lay right through the scarce season, January to June, when the majority of hens in the country are in their annual moult and out of production. Pullets may also moult, however. This pullet moult is of vital importance, and therefore has been given careful study. It is to some extent hereditary, but also due to environmental conditions.

Stud breeders should always note autumn pauses in production, especially of long duration, indicating a moult, in the records of pullets, and select breeders with little or no tendency to a drop in production during March to June.

It has been found in practice that pullets that commence to lay before Christmas are more likely to have a pullet moult due to environmental conditions than pullets which start laying after the New Year. This means the main flock of pullets, especially of the Light Breeds, should not be hatched before July. This practice allows for greater sales of eggs during the scarce season from breeding hens.

Pullets hatched after September do not grow well in the hot weather and when mature miss a considerable period of the high egg price season.

MATURITY.

A pullet is not physically mature until ten months of age, although it may commence to lay in half that time. It is therefore understandable that until it is mature a very great strain is placed on the system, which is performing two functions—growth and production. This period of growth and early production coincides with the period January-June and the natural moulting season. Anything in the way of environmental disturb-

ance will cause the pullets to cease laying and a partial moult usually follows. It is not that a pullet ceases to lay because it moults, but that it moults because it ceases to lay.

In the writer's opinion, the main cause of pullets moulting is that they lose condition because they are underfed or inadequately fed to perform these dual functions of laying and maturing physically. If food is insufficient or unbalanced, production suffers first.

Of recent years the dual purpose breeds have become increasingly popular largely because they have the reputation of being excellent autumn layers, and have proved this contention on laying tests. The reason for this is that they carry more body weight than the Light Breeds and therefore have more stored energy in fat to fall back upon where the food intake is inadequate in any respect. Another reason is that they are less temperamental and management is less likely to fail with them. Where food is sufficient in all respects and management correct, the Light Breeds can be equally good autumn producers.

FEEDING GROWING STOCK.

It is therefore the object of the farmer to rear pullets that come into lay at the best time and in the right condition and thereafter to full feed them until they are fully mature. Chickens grow quickest in the early stages of life and therefore require more protein at this time, which is from hatching to eight weeks of age. After this age growth slows down somewhat and less protein is required.

A convenient feeding practice to fit in with these requirements is to feed an all mash ration containing 20 per cent. of protein to the chickens until eight weeks of age. From this age commence feeding scratch grain in addition to the mash, because the grains are high in carbohydrates and low in protein and therefore automatically lower the ratio to the requirements. The grain feed should be gradually increased until when laying commences the consumption of grain and mash should be equal quantities.

This system is excellent in practice and lends itself admirably to the needs in particular flocks. If the pullets at three to four months show signs of too early sexual maturity the mash consumption should be reduced and the grain increased. In the case of late hatched or neglected pullets which it is required to hurry along they may be left on the all-mash ration longer or the grain ration may be limited.

Only one mash is required fsom hatching to maturity with this system of feeding—in fact, the same mash may also be excellent for production.

Cockerels should be fed in the same manner for the quickest growth.

HOUSING AND MANAGEMENT.

It is better to have three rearing stages:—(1) Brooder stage; (2) small pen stage; (3) free range colony stage.

During the brooding stage, which may be for three weeks to six weeks according to housing and time of year, chickens require careful attention and proper conditions according to the system of brooding adopted to give the quickest rate of growth and the cheapest gain.

Cold box brooders for small numbers have proved themselves over many years and produce hardy chickens which can be placed in open-fronted houses earlier than chickens receiving artificial heat. (See Bulletin 1390.)

For larger numbers heated brooders of many types are used with success. Electric brooders and those requiring less labour are becoming more popular every year. When the chickens can be removed to small houses with hessian canopy and open front, they may frequently leave the brooder at three to four weeks, especially after August.

A house 6 ft. by 6 ft. by 5 ft. high with netting front and hessian canopy 2 ft. from floor level and 2 ft. wide will accommodate 100 three-weeks-old chickens until two months of age.

The chickens are bedded down well beneath the canopy, which has sacking weighted down to floor level in front to keep them confined at night. The front curtain is raised gradually according to weather conditions until it is folded back completely, usually after two to three weeks. Bedding is then placed all over the floor, and the canopy which is resting on projections from the wall folded back as soon as the chickens spread away or commence to perch on it. When this is done, a low, flat set of perches 3 ins. wide and 6 ins. apart is put in on the floor, on top of the bedding. At this stage cockerels may be removed and all stock changed over to free range colony houses soon after.

In this second rearing stage the chickens are confined to runs and it is important that these pens be kept exclusively for rearing chickens and not used at any time for adult poultry, to avoid disease and internal parasites. It is preferable to have the chickens in pens up to this age (six to eight weeks) as they can be better observed and managed. If this second rearing stage is not used, then the chickens must remain in the brooder house until six weeks of age and heat gradually reduced. They are hardly ready to go on range at six weeks and so the second-stage method of rearing is certainly worth while.

In the third stage pullets and cockerels are of course divided and placed, preferably at eight weeks, in portable colony houses with slatted floors on free range. A 6 ft. by 6 ft. floor space will house fifty growing stock until ready for the laying house any time after five months of age.

During the rearing period little or no rain is experienced, so young stock can make full use of free range conditions. It is the hottest period of the year towards the end of the season and shade must be available. It is important also to provide ample green food, as there is little of this to be found under natural conditions untol the rains break.

After laying commences, as stated previously, the pullets have still some four to five months to go before they are physically mature, therefore full feeding is most important for this period.

In order to ensure the maximum intake of mash where the dry mash system is used it is very desirable to give one feed of wet mash to the pullets daily from the time they commence laying until the spring production starts in August. By this time they are 12 months old and fully mature, but it is not advisable to make any drastic feed changes before July or August which may cause a partial moult.

The wet mash should therefore be fed from about December to early August and then gradually stopped. Feed sufficient for the pullets to clean up in an hour at most. The dry mash is available to them at all times. The grain feed should be fed at the rate of 10-12 lbs. per 100 birds daily according to production and breed. It should be fed once daily in the afternoon, allowing time for it to be consumed before dark.

Report on the Southern Rhodesia Wheat Crop

For the 1946 Season as received at Salisbury

By Mr. BLAIR, Rhodesian Milling and Manufacturing Company, Salisbury.

INTRODUCTION.

By T. K. SANSOM, B.Sc., Acting Chief Agriculturist.

The following report on the Southern Rhodesian Wheat Crop for the 1946 season is mainly of interest to millers, bakers and the consuming public.

To the grower, provided his wheat does not weigh less than 62 lbs. per bushel, there is little or no inducement to produce high quality wheats in view of the fact that these high quality wheats do not yield as well as the poor quality wheats, such as Punjab 8A, under present farming conditions.

Until wheat is paid for on grade, there is little likelihood of high quality wheats being grown for the above mentioned reason.

That Southern Rhodesia can produce wheats of high quality has been proved time and again over many years at the Plant Breeding Station, Salisbury. Results of baking trials in this country and overseas have amply proved this fact; so that it is not strictly accurate to say, as the report states, that the Rhodesian wheat crop is deteriorating in quality.

The quality of the Rhodesian wheat crop, apart from the seasonal variations, can be maintained, provided growers practice good farming methods. A liberal supply of nitrogen obtained from ploughing in a green crop, or the application of compost or kraal manure, or artificial nitrogenous fertilisers together with other fertilisers will not only increase the protein content and at the same time the quality of the wheat, but will secure increased yields per acre.

This crop was received in two types of bags, Australian wheat bags containing approximately 180 lbs. of wheat and ordinary grain bags containing approximately 200 lbs. This factor has not been taken into account in arriving at the figures stated in this report.

The 1939 crop was the last one reported on by the writer and in some cases comparative figures for that year are given in brackets.

1. **Grading.**

(a) Total crop received:—12,721 small bags, 14,759 large bags. Total, 27,030 bags (27,203).

(b) Native Crop:—4,905 bags, or 18.1% of total (3.02%).

(c) Number of bags under bushel weight of 62 lbs.:—578 bags, or 2.2% of total crop (24.4%). Note that in 1939 the bushel weight was 62½ lbs.

(d) Grading Reductions. European crop:—

Reduction due to	No. of bags.	Amount deducted.
Bushel weight	521	£14 6 6
Broken wheat	958	110 14 9
Grit	151	4 19 10
Screenings, moisture, etc.	112	3 18 7
		£133 19 8

Native Crop:—

Reduction due to	No. of bags.	Amount deducted.
Bushel weight	57	£1 0 3
Grit	425	8 10 1
		£9 10 4

Average reduction, European crop = 1.45d. per bag.

" " Native " = 0.51d. " " (1.74d.)

" " Total " = 1.27d. " " (2.98d.)

There has been a steady increase in production by the natives. Although the varieties are usually mixed, generally speaking their wheat is of good quality and is efficiently grown and harvested. They understand the system of grading being used and they now prefer to sell their own wheat rather than deal through traders.

It is interesting to note that it is the different methods of harvesting and not the growing of the crop which accounts for the fact that the Native crop reduction per bag is approximately one-third of that of the European. With mechanical harvesting equipment the European tends to cut his crop before it is quite mature to prevent loss from fallen grains. Also the combined harvester-thrasher eliminates the stooking period. These factors tend to lower the bushel weight.

If the thrasher is not properly set the wheat is shattered and this accounts for the broken grains. The Native harvesting by hand allows the crop to mature so that thrashing and winnowing

will be easier. Generally, the more mature the grain, the higher the bushel weight. However, in sweeping up after these operations grit finds its way into the bags and is responsible for most of the reduction made on the Native crop.

2. Sources of Production.

(a) Number of bags grown in various districts.

Arcturus	250	(228)
Beatrice	2,439	(4,136)
Eastern Districts	1,680	(688)
Featherstone and Enkeldoorn	5,410	(15,970)
Hartley	135	(260)
Inyanga	283	(73)
Lomagundi	108	(187)
Macheke	83	(67)
Marandellas	212	(108)
Mazoe	6,231	(1,935)
Mondoro Reserve	4,628	(823)
Odzi	75	(60)
Rusapi	61	(54)
Salisbury	4,436	(1,257)
Shamva	999	(1,341)

(b) Growers who produce over 300 bags.

Boonzaaier, C. P.	Featherstone	315
Bronkhorst, R. P.	Beatrice	386
B.S.A. Company	Mazoe	2,759
Bruce, J. T.	Featherstone	518
Edwards and Sons	Salisbury	896
Frogmore Estates	Mazoe	2,276
Hoffman, L. J.	Beatrice	533
Kok, H. G.	Featherstone	392
Morkel Bros.	Shamva	830
Noaks, E. W. L.	Mazoe	315
Premier Estate	Umtali	762
Riverside Estate	Mazoe	419
Springs Farm	Salisbury	682
Staunton, J. A. L.	Salisbury	904
Townsend, R. O. C.	Salisbury	1,738
Wheeler, J. W.	Featherstone	380
Wheeler, T.		386
Wheeler, Z.		314

Note the decrease in production of the Featherstone, Enkeldoorn and Beatrice districts, and the increase in the Mazoe and Salisbury areas, Eastern District and Mondoro Reserve.

There appears to be a general tendency for the growers on the better types of land, and in many cases using irrigation to increase their production. The worker on poorer types of land, who generally uses a wet vlei, is reducing his production.

3. Quality of the Wheat.

Average Moisture = 10.60%
Average Protein = 9.69%

Punjab 8A has increased in popularity during the last three seasons and is now the most widely grown variety, owing to the fact that it is a good yielder.

The following figures show the deterioration of the quality of the Wheat Crop as indicated by the protein and also how two varieties deteriorated over three or four years.

WHOLE CROP.

Year.	Average Protein.
1935	11.36%
1936	10.80%
1937	11.23%
1938	10.54%
1939	10.34%
1940	10.00%
1941	10.37%
1942	10.33%
1943	10.81%
1944	9.59%
1945	9.80%
1946	9.69%

Punjab 8A.		Reward.	
Year.	Average Protein.	Year.	Average Protein.
1942	10.71%	1936	13.45%
1943	10.39%	1937	13.37%
1944	9.80%	1938	12.33%
1945	9.97%	1939	10.18%
1946	8.82%		

In the 1939 report suggestions were made for seed control with a view to improving the quality of the crop. Some of these suggestions have been adopted. Wheats grown under good conditions at the Government Experimental Stations show a rapid drop in quality when they go out to the farms. This points to the fact that improved farming practice is necessary.

4. **General.**

The quality of the Southern Rhodesian Wheat Crop is deteriorating. During the years 1935 to 1938 it was considered to be a "filler" wheat in the grist, but since then it has gradually been becoming more and more of a passenger in that it has to be carried by stronger wheats.

Both the quantity and quality of the protein in Punjab 8A is poor, and yet it is estimated that this variety comprised at least 65 per cent. of the 1946 crop. More alarming, and as a pointer to the future, all the Government Certified Seed Wheat from this crop was Punjab 8A.

If the quality of the Southern Rhodesian Wheat Crop continues to drop from its present low level, then it would not be favoured in a grist when the world wheat situation returns to normal.

The Commonwealth Mycological Conference

By J. C. F. HOPKINS, D.Sc.(Lond.), A.I.C.T.A., Chief Botanist and Plant Pathologist, Department of Agriculture.

(Broadcast from B.B.C. on August 13th, 1948.)

I am afraid that the title of this Fourth Commonwealth Mycological Conference which I have just attended is a bit confusing. To those of you—probably the majority—who don't know what the word "mycological" means, the whole affair must be a complete mystery; and even to those who do know the word, the name probably suggests a long confab. about moulds and mushrooms. In fact, the suitability of the title was actually questioned at the final plenary session, and it is likely that the name will be changed before our next meeting in five years' time.

Now let me try to explain what the conference was all about. For the information of the uninitiated, "mycology" means the study of fungi, and it was by such studies that we obtained our knowledge of the fungi which cause plant diseases. Scientists who studied plant diseases were therefore known as "mycologists," and a central institute, which was set up at Kew to assist mycologists in the Commonwealth, became known as the Commonwealth Mycological Institute. But it is now known that plant diseases are not all due to fungi; they may be caused by bacteria, viruses and mineral deficiencies, among other things, and the scientist who studies them and advises farmers how to control them is called a "plant pathologist," or, in simple language, a plant doctor. So, you see, it would have been more apt if our meeting had been styled the "Commonwealth Plant Pathological Conference."

If I rapidly run through the agenda you will see what a wide range of subjects were discussed and how vital to agriculture:—Administrative measures against plant diseases; the control of virus diseases; diagnosis of nutritional diseases; losses of stored products due to moulds; two whole sessions on the certification, use and development of fungicides and insecticides; the biological control of insects and weeds, and diseases of forest trees.

After the official opening we got down to business on what many of us considered to be the most important item on the agenda. This was to discuss a number of draft resolutions on plant quarantine for Africa which had been submitted by a Conference of Colonial Experts held in Brussels in 1947. The Brussels Conference proposed the setting up of an international convention to control the importation of plants and seeds into Africa, in order to prevent introducing serious pests and diseases not already present in the Continent.

To some of my Rhodesian listeners this may sound like shutting the stable door after the horse has got loose; but let me assure you that I have in my possession a list of serious plant diseases not yet recorded from Africa, which covers a foolscap page of close type; and I have no idea at all how many pages are covered by the list of insect pests. So you see that it is not only the "*people* living in it" who are the cause of trouble in this world. As air transport facilities improve, every territory in Africa must view with grave concern the possibilities, now rapidly becoming probabilities, of introducing insects and plant diseases which could make the plagues of Egypt look like an advertisement for a patent medicine.

The South African delegate, Dr. van der Plank, explained the system which since 1932 has successfully prevented the introduction from overseas of any major pest or disease into the Union, Southern Rhodesia, Northern Rhodesia, the Belgian Congo and Nyasaland. These States agreed in 1932 to prohibit the entry of certain kinds of plants such as eucalyptus, stone fruits, and citrus; to allow in others by permit only; and to place no restrictions on plants and seeds which were unlikely to introduce diseases and pests. They also agreed to allow the interchange of agricultural and horticultural plants between themselves under mutually agreed regulations. For instance, Southern Rhodesia prohibits the importation of dahlia tubers from the Union, because of the danger of introducing a serious virus which occurs in the South and is capable of killing tobacco. At the same time, Rhodesia gives annual import permits to accredited nurseries in the Union, which are regularly inspected by the Union Department of Agriculture.

Our Conference last month eventually agreed to recommend extending this principle to include all the African territories south of the Sahara, working on a regional basis. The essence of the Convention would be that all States would agree to common minimum legislation, but each territory would be free to make more stringent regulations for its own protection, after consulting with other States concerned. Here's a possible example. Cocoa is of great importance to West Africa, but is not an economic crop in the Union. It might be, however, that a cocoa plant introduced into the Union as a glasshouse specimen could harbour a very serious disease or pest which might, in time, find its way to West Africa and cause untold trouble. Under the proposed agreement West Africa would make a list of cocoa diseases and pests it wished to keep out and would advise all other African States in the Convention. They in turn would place

on cocoa the restrictions that West Africa asked for. This principle has been found in Southern Africa to stimulate mutual confidence between States and is really the keystone of the whole structure.

The area south of the Sahara was chosen as a unit for several reasons, but mainly because of the administrative difficulties in dealing with the whole of Africa in what is essentially an experiment. But it was proposed that a permanent commission be set up to implement the Convention and to bear in mind the possibilities of eventually including Northern Africa.

It was pointed out at a later session that seeds are a lively source of plant diseases but internationally accepted standards of seed testing do not at present include analysis for disease. For this reason, seed certified as of high grade for germination, purity and quality might be a menace to agriculture because of the disease organisms which it contained. The Conference therefore recommended that at least one mycologist, or plant pathologist (note the distinction-) should be appointed to the staffs of all seed-testing laboratories in the Commonwealth. To me this was very gratifying support for the policy being followed in Southern Rhodesia, because the new seed-testing laboratory just opened in Salisbury is being developed by one of my professional officers, who is trained in both seed analysis and plant pathology.

Then we had a whole day on plant viruses, those still mysterious substances which appear to be half-way between the living and the dead. We were even able to see what virus particles look like, with the aid of an electron microscope, when we visited the famous Rothamsted Experimental Station. Those of our common tobacco mosaic-virus, when magnified about 17 to 20,000 times, appeared as rods of varying length, whilst the particles of tomato bushy stunt were quite spherical and looked like a collection of tiny marbles in groups of different shapes and sizes.

The workers from West Africa told us of the colossal losses caused by swollen shoot, a virus disease of cocoa. Its control looks easy on paper, but is complicated by political factors. Then Dr. van der Plank told us all about the schemes for certifying seed potatoes against virus diseases in the Union, and a delegate from Canada described research work on the identification of virus diseases of stone-fruit trees.

Another whole day was spent on a discussion of fungicides and how they could be improved. Canada and New Zealand have had much success in eliminating useless products from the market by schemes of Government certification. The difficulties of employing fungicides on tropical crops, mainly grown by peasants, were described for India, and apply just as well to native cultivation in Southern Rhodesia. If the world is to feed itself, food production in the tropics must be stepped up enormously, and one obvious way of increasing production is to eliminate losses caused by crop diseases. The use of fungicides must be introduced, but many difficulties must first be overcome by education and research. For instance, the yields are so low on most peasant holdings that if you could increase them, say, by 20 per cent. by

disease control, the difference would be hardly noticeable and would not pay for the materials. Fungicides are expensive, as they have mostly to be transported over long distances. Spraying machinery has been desgined for Western requirements, and you cannot expect a native to indulge in £500 worth of equipment; yet smaller machines suitable to his purse are inefficient on most crops. For fungicides to be economic it is necessary first to improve methods of agriculture and to design machinery suitable for use in the tropics. The sooner this happens the better it will be for Africa.

We had a very interesting session on the role of minor elements in plant nutrition and the diseases produced by their deficiency or excess. Rhodesian farmers will no doubt be interested to hear that a deficiency of calcium or an excess of manganese can both cause complete failure of cabbages and potatoes on acid soils. The yield of potatoes has been raised from 7 tons to 21 tons an acre by spraying apparently healthy crops with dilute solutions of salts of manganese and zinc. So you see that some of these deficiencies do not produce visible symptoms, and we shall have to readjust our ideas of what is a healthy crop.

Not all fungi are harmful. The Commonwealth Mycological Institute has recently taken over the National Collection of Fungi from the Lister Institute, and the Conference approved of this new project. The collection is continually checked so that authentic species can be guaranteed, and this is very useful to certain industries which rely on fermentation by fungi for their commercial products. The classical example of this is, of course, penicillin, but there are many others, and in the few months since the collection has been acquired no less than 350 cultures have been supplied to commercial firms. Mycologists also need these cultures to help them to identify fungi, and it is extremely important that a species should be maintained in the form in which it was first described. But fungi have a habit of changing in artificial culture, so that much research is needed into improved methods of storage and on culture media which will promote normal growth.

Many other matters were discussed, mainly of a technical and scientific nature, but there is no time now to tell you all the interesting points which cropped up. Probably the most valuable parts of these specialist conferences are the informal discussions and visits to research institutes, and we hope that in future much more time will be allowed for this interchange of ideas and knowledge. I am returning to Rhodesia not only with a good deal of new information about plant diseases, but also with numerous offers of assistance in our problems from colleagues in all parts of the Commonwealth. I think you will agree with me that from all these points of view the time and trouble spent have been very well worth while.

How to Produce Clean Milk

By J. R. CORRY, B.Sc.Ag., Chief Dairy Officer.

Although the past few years have seen a very definite advance in dairying methods in the Colony, it cannot be denied that there is still room for improvement in the conditions under which milk is produced and handled on our dairy farms; far too large a proportion of the milk and cream supplied to our factories and dairies is still of inferior quality, a state of affairs which could be quite easily remedied if dairymen would only make the necssary effort.

What is Clean Milk? "Clean milk" is not necessarily milk which contains no visible dirt or from which dirt has been removed. The term "clean milk" means rather the raw milk of healthy cows containing very few bacteria. Dairymen should realise that most of the defects found in milk and other dairy products are caused by bacteria of different kinds which gain entrance to the milk from a variety of sources and the secret therefore of producing clean milk and high grade dairy produce is to expose it as little as possible to these sources of contamination—and to keep it cool—from the time of production until delivery to the dairy or factory as the case may be.

Many producers seem to be under the impression that in order to do this a considerable outlay of capital is necessary for buildings and equipment. This is far from being the case for it has been repeatedly demonstrated that clean milk can be produced anywhere at any time merely by observing a few simple precautions. Expensive equipment, elaborate buildings are not essential. At the same time, it is undoubtedly easier to produce good work with good tools, and for this reason the dairyman who aims at producing milk of high grade quality will find it an advantage to provide himself with a certain minimum in the way of facilities and equipment.

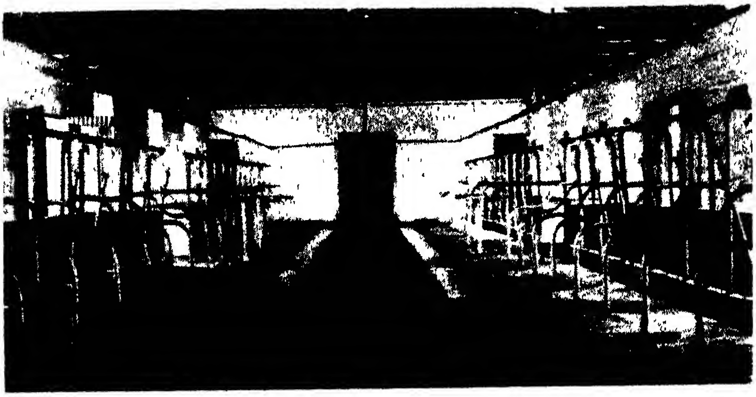
What are the Chief Sources of Contamination? The chief sources of contamination of milk are the cow herself, the milking place, the milker, flies and the utensils.

Unless she has a diseased udder—in which case the owner should consult a veterinarian—the cow herself is not usually a serious source of contamination except under conditions where it is the practice to stable cows at night; in this Colony there is no reason why cows should not be allowed out night and day throughout the year and where this system is followed it will be found that the animals keep very much cleaner than those which are stabled.

The milking shed, if kept reasonably clean and free from dust, should not be a serious source of contamination. If, how-

Fig 1. Keep Good Cows. It is easier to produce clean milk from a few good cows than from a stableful of low producers.

(Dairy herd at Grasslands Experimental Station, Marandellas.)



Figs. 2 and 3.—Milk in clean dust-free surroundings like these.
F. B. Morrisby, Sunnyside Farm, Gwelo.

Fig. 3.—T. Adams, Blackfordby, Salisbury.

Fig.4.—Wipe the udder and teats of the cow with a clean wet cloth.

Fig. 5.—See that the milkers are clean and that they wash their hands in clean water before milking each cow. (Note simple but effective arrangement for washing milker's hands—a discarded milk can fitted with a tap)

Fig. 6.—Use cow cobbles, not reims, for tying the cow's hind legs.

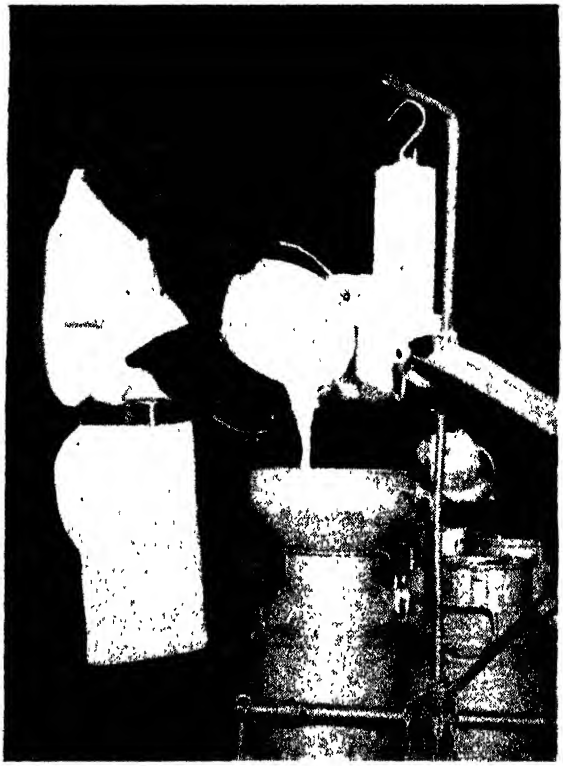


Fig. 7.—Strain the milk through a proper strainer.

Fig 8.—Clean the utensils immediately after use. First rinse the utensils in cold water.

Fig 9.—Then scrub the utensils in hot water containing some cleaning compound. Then rinse again in hot water.

Fig. 10.—Sterilise all utensils by steam after they have been cleaned. This shows a steaming cabinet or chest into which steam is discharged from a boiler for sterilising purposes.

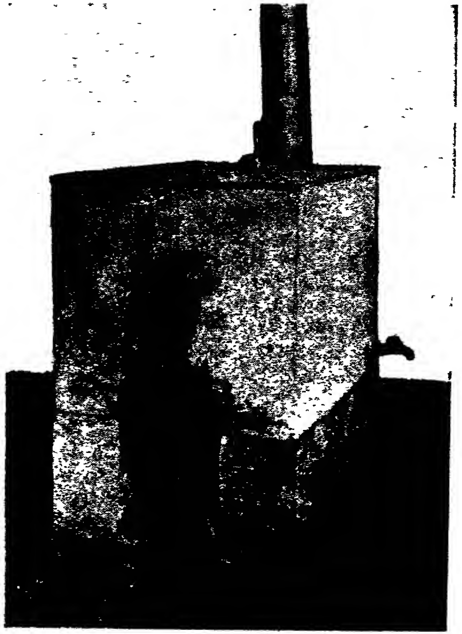


Fig. 11.—Galvanised iron box steriliser.

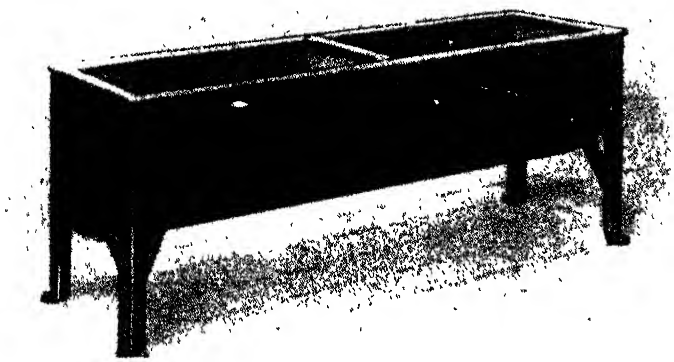


Fig. 12.—Galvanised steel wash up trough, with two compartments, for cold and hot water.

ever, the cows are milked immediately after the shed has been swept out or if dry, dusty foods such as hay, etc., are fed during or shortly before milking, then the resultant dust-laden air of the milking place may add considerable numbers of bacteria to the milk. The milker may also be a source of contamination in as much as he may add organisms to the milk from his clothing and hands, particularly if wet milking is practised.

Another commonly ignored source of contamination is the ordinary house fly. As many as 6,000,000 bacteria have been found on the body of a single fly; furthermore, flies are so commonly associated with dirt and manure that contamination from this source is not only objectionable from a dairyman's point of view but may also be dangerous to health.

There is little doubt, however, that the most serious sources of contamination of milk are unclean, unsterilized utensils of all kinds, including milk buckets, strainers, coolers and cans. The thin film of milk which adheres to surfaces of all milk utensils is difficult to remove and if allowed to remain makes an excellent breeding place for bacteria. Investigations have shown that the number of bacteria which gain entrance to milk from the air and dust and from the milker and even from the cow herself is insignificant compared with numbers contributed by unclean, unsterilized utensils.

This is a fact not sufficiently appreciated by the average dairyman and there is little doubt that in this Colony, unclean, unsterilized utensils are responsible more than any other single factor for our comparatively high percentage of low grade milk and dairy produce.

There are thus five main sources of contamination on the farm all of which are under the dairyman's control. It should be his aim to reduce contamination from these sources to an absolute minimum and this can quite easily be done by observing the following simple precautions.

HOW TO PRODUCE CLEAN MILK.

1. **Keep Good Cows.** Fewer and better cows mean more and cleaner milk. It is easier to produce clean milk from a few good cows than from a stableful of low producers.

2. **Milk in Clean, Dust-free Surroundings.** For this purpose a proper milking shed should be provided. This may take the form of a simple lean-to shed in which a few cows can be milked at a time or, if desired, a more elaborate cow stable according to circumstances. In either case, the shed must have the essential features of a cement floor, abundant ventilation and proper drainage. Manure, etc., must be removed from the shed after each milking.

Do not brush or groom the cows or sweep out the milking place immediately before milking and always feed dry, dusty foodstuffs such as hay, etc., after milking has been completed.

If possible do not stable the cows overnight in the milking place. When grazing is plentiful the cows can be out day and night. During the dry season a useful arrangement is to keep the cows in pens—similar to those used for fattening bullocks—in which they can be fed all roughage such as hay, silage, etc., and from which they are only allowed out for watering and milking.

3. **Practise Clean Milking.** Wipe the udder and teats of the cow with a clean, wet cloth which had been dipped in a solution of some disinfectant. Do not use one cloth for thirty or forty cows—for this number use at least half a dozen clean cloths and a similar number of pails of disinfectant.

See that the milk boys are wearing clean clothes or overalls and that they wash their hands before milking each cow. Running water is really essential for this purpose; if water is not laid on to the milking place, as it should be, then a small six or eight gallon drum fitted with a tap and mounted on a frame or bracket on the wall of the shed will serve the purpose; the water in the drum should contain disinfectant. To start with, however, the milker should wash his hands thoroughly with soap and water. Do not allow the milkers to practise wet milking and insist on the fore-milk being collected in a special bucket or container reserved for the purpose. If a teat lubricant is necessary, use vaseline or some similar grease. If the cow's hind legs have to be tied for milking then proper cow hobbles—chain and clamps—should be used. Do not use reims for this purpose.

4. **Get Rid of Flies.** Flies breed in manure so that the further away the manure can be carted from the milking place the better. Use fly traps in and about the milking place and dairy. Don't leave manure lying about near the milking place.

5. **Strain the Milk through a Proper Cotton-wool Strainer.** It is better to keep dirt out of the milk than to strain it but even on the most carefully managed dairy farms a certain amount of extraneous matter finds its way into the milk and the sooner it is removed the better.

6. **See that all Dairy Utensils are Properly Cleaned and Sterilized each time after Use.** This is of paramount importance. In the cleaning and sterilisation of dairy utensils it is necessary first of all to bear in mind the fact that dirty apparatus cannot be effectively sterilized and that it is essential, therefore, that all remnants of milk and cream, dirt and other matter should be completely removed from all dairy equipment before sterilisation takes place. Secondly, it should be remembered that rusty utensils or equipment and containers which have become dented or battered from continual use are almost impossible to clean and sterilize. All dairy utensils should be cleaned in the following manner:—

(i) Rinse the utensils immediately after use in cold or luke warm water. If they are not rinsed immediately after use but are allowed to stand about for an hour or more before receiving attention, then the film of milk which is left in the utensils will dry out on the surface of the

equipment leaving a fine deposit and make subsequent cleaning more difficult. Cold or luke warm water must be used for the first rinsing; if hot water is used the milk remnants are liable to be baked on to the utensils in the form of a thin film which ultimately will have to be removed by means of a scouring powder or abrasive.

(ii) After rinsing, scrub the utensils with brushes and hot water containing 2 to 3 per cent. of washing powder; the latter serves to remove all fat and grease from the utensils. Soap and cloths should never be used for washing dairy equipment as they simply tend to smear the dirt on to the utensils and make them greasy.

(iii) After the utensils have been scrubbed with brushes they should be rinsed in hot water to remove the dislodged dirt and the washing powder solution.

Cleaning of utensils as described is a very simple process and yet it is astonishing how commonly this operation is neglected with the result that in time the utensils become covered with a film of milk remnants. Utensils in this condition are obviously a serious source of contamination to any milk or cream with which they come into contact.

The usual trouble is lack of proper facilities for cleaning the utensils and it is a common sight to see the dairy boys attempting to clean half a dozen milk buckets, four or five cans, a milk cooler, strainer, etc., in a small drum containing a few gallons of water with the result that rinsing and cleaning operations are so prolonged that the last few items of equipment to be cleaned inevitably become covered with a film of milk remnants which, as previously mentioned, may be very difficult to remove. Adequate facilities for rinsing and cleaning utensils must be provided.

For a small producer these can be cheaply contrived out of two 40-gallon oil drums cut lengthwise in half, one half being used for scrubbing in hot water, another half drum being used for rinsing in cold water, and a third half drum being used for the final hot water rinse. Figs. No. 9 and 10 show a very effective wash-up tank made from an oil drum cut lengthwise in half.

Containers such as these, however, would obviously not be adequate for dairymen operating on a large scale who would require three or at least two fair-sized tanks large enough to hold most of the utensils at the same time. Proper wash-up tanks, made to order, can be obtained in the Colony.

After being cleaned as described the utensils should be sterilized. For all practical purposes sterilisation can be effected by exposing the utensils to a temperature of at least 200 deg. F. for a minimum period of 25-30 minutes. This can be accomplished either by immersing the utensils in boiling water for 25 to 30 minutes or by steaming the equipment in a box or cabinet for a similar period. Mere scalding of the utensils, i.e., dipping them in hot water, is not sufficient.

Immersion of the utensils in boiling water is not usually feasible except in the case of a small producer who has only a couple of milk buckets, etc., to sterilise. It is usually more practicable to sterilise the utensils in a steaming box or cabinet. In the case of a small producer a very satisfactory sterilizer can be improvised from one or more 40 gallon drums. The top of the drum is cut off a few inches from the top and about 2 inches of water is then placed in the drum, which is then set up over a fire on a few bricks. When the water is boiling the utensils are placed in the drum in an inverted position on a rack a few inches above the boiling water. The lid is then placed on top of the drum and the utensils are left to be steamed for a period of 25-30 minutes. This arrangement would obviously not be satisfactory for a dairyman operating on a large scale and who may have seven or eight buckets as well as half a dozen large cans, milk cooler, strainer, etc., to be sterilised. In this case a large square tank, similar in principle to the small oil drum steriliser, may serve the purpose; alternatively a steaming cabinet should be installed into which steam can be discharged from a steam boiler, or, if electric power is available, an electrically operated steaming chest may be used. These are now being made in the Colony. For ordinary purposes, high pressure boilers are not essential. Low pressure boilers—i.e., a gauge pressure of 2 lbs. per square inch—are quite satisfactory as long as the volume of steam delivered is sufficient. The Boltt boiler (Bulletin No. 1361) is a good example of an efficient low pressure boiler. Whatever method of sterilisation is adopted, it is essential that the temperature inside the sterilizer should be maintained at at least 200 deg. F. for a minimum period of 25-30 minutes and the only way to make sure that this temperature is being maintained is to fit a thermometer to the sterilizer or to place a maximum and minimum thermometer in the steam chest at each sterilisation.

After sterilisation the utensils should be placed in the dairy. They should not be dried with cloths after being removed from the sterilizer as this merely causes recontamination. If the temperature in the sterilizer has been sufficiently high—i.e., at least 200 deg. F., then the utensils should be so hot that any moisture thereon will immediately evaporate.

It is obvious that there is nothing complicated or difficult in the procdure outlined above for the production of clean milk nor is there any excuse for any farmer not providing himself with the facilities described; in many cases these can be contrived or improvised from equipment found on the farm.

There is little doubt that the quality of our milk and dairy produce generally would be enormously improved if every dairyman in the Colony made an effort to observe the elementary precautions outlined above; let us hope that the next few years will see considerable progress in this direction.

SUMMARY.

How to Produce Clean Milk.

1. Keep good cows—fewer and better cows mean more and cleaner milk.
2. Milk in a clean, dust-free place.
3. Wipe the udder and teats of the cow with a clean, wet cloth.
4. See that the milk boys are clean and that they wash their hands in clean water before milking each cow.
5. Don't permit wet-milking. If necessary use vaseline or some similar teat-lubricant.
6. Don't milk the first milk or fore-milk on the floor; collect it in a special container.
7. Use cow-hobbles—and not reims—for tying the cow's hind legs.
8. Get rid of flies.
9. Strain the milk through a proper strainer.
10. **Most important of all, see that all utensils are properly cleaned and sterilised each time after use.** Don't guess at the sterilising temperature--use a thermometer.

Don't use soap and cloths for cleaning or drying dairy utensils!

Management of the Coal Furnace for Tobacco Barns

By CAPT. C. E. LOWE, C.B.E., R.N., retired, Research Engineer, Tobacco Research Station, Trelawney.

INTRODUCTION.

The use of the coal furnace for heating tobacco barns has certain advantages. For example, when coal instead of wood is used as a fuel, more efficiency and greater control of heat output is possible. If these desirable objectives are to be achieved, however, the furnace must be operated correctly. If the methods of procedure detailed in this article are followed, farmers should experience no difficulty in obtaining a satisfactory performance from this type of furnace.

PROVIDE THE RIGHT TOOLS.

The first essential in obtaining maximum efficiency from the coal furnace is the use of the proper tools for tending the fire. Even a skilled operator could scarcely expect to control a coal fire properly using a piece of bent piping as a tool, let alone the unskilled native labourer normally employed in Southern Rhodesia.

Experience gained over many years has led gradually to the evolution of standard types of tools and these now form the regulation equipment for stokers. One set of tools comprises a shovel, a rake, a slice and a devil.

The shovel should be of the "Navigator" type, shaped rather like the "ace of spades." For use by native stokers, a size about 8 inches wide and 10 inches long has been found suitable; use of the larger size about 9 inches wide and 13 inches long usually leads to over-stoking. These tools form a very necessary oufit for controlling a coal fire furnace, especially as considerable demands are made on the furnace, which makes optimum efficiency essential. The correct use of these tools should also result in economy of fuel, a saving of both time and money and the production of a better cured leaf.

One set of tools is adequate for six fires; but one shovel should of course be provided for each stoker. They are not expensive; a set will cost about two pounds. Arrangements for their manufacture may be made with any of the local engineering firms or blacksmiths.

ESSENTIAL ACCESSORIES

The Chimney. Coal requires about one and a half times as much air as wood if it is to burn efficiently. For this reason, the 9-inch chimneys usually fitted to wood burning furnaces are not adequate for the coal furnace. A chimney of at least 14 square inches cross section is needed to deal with the increased volume

of gas. Many farmers, in fact, have found it mpossible to obtain the required temperatures when attempting to run a coal furnace with the 9-inch chimney. Others have found it possible to make the small chimney function; but only at the expense of burnt-out flues and a much greater expenditure of coal than should be necessary.

On one farm the first 8 feet of flue pipe was burnt out and a brick tube was then substituted; but this only resulted in a still greater fuel expenditure. The root cause of the trouble is the very long flame produced when a small chimney is employed. Failure to provide the right sized chimney will therefore result in tar deposits in the flues, burnt out flues, accumulation of soot and a very heavy and unnecessary expenditure of fuel.

A coal furnace normally using 30 lbs. of coal per hour requires a chimney of at least 14 square inches cross section; it can be larger, even up to 3 square feet, but such a large chimney would mean a waste of bricks.

A 9-inch chimney which is bonded into the wall can be converted to the required size by supporting the base, removing the outside wall of the chimney and then extending the two side walls so that they project 2½ bricks from the barn wall. The chimney will then be 9 inches by 21 inches inside. Prints showing how to fit an inside furnace to an existing barn can be obtained from the Editor, R.A.J. office.

Ash Can. The furnace should be provided with an adequate ash can. It is useless to cement the bottom of the furnace, as the cement cracks under heat, with the result that water gets into the foundations and this causes steam to form which may burst the brick bonding.

Steel Tray. If the furnace is inside the barn, the steel tray is required to cover its top in order to protect the lower tiers of leaf, in the region of the furnace, from excessive heating when drying out. The tray is also useful for holding wet sacks during the wilting period. Trays made of aluminium are useless.

OTHER USEFUL ACCESSORIES.

Bunker. It will be found very handy to provide a small bunker to the left of each furnace door. A small open top bunker 3 feet wide by 2 feet high, with a hole 1 foot wide and 1 foot high in the front and fitted with a layer of brick to form the shovelling plate is quite adequate. A bunker of this size will hold about half a ton of coal. It is shown in fig. 12.

With the bunker situated on the left-hand side of the furnace, the stoker is enabled to take a shovelful of coal and put it on the fire without having to move his feet. This ensures that the furnace door need be open for the minimum time and thus undue fall in temperature is prevented. The furnace temperature can fall very considerably if the furnace door is left open; the stoker should therefore be taught to keep the furnace door open for as short a time as possible once the fire is spread.

The use of the bunker should help to prevent coal being scattered all over the front of the barn, thus saving fuel.

Instances have been noted where the area around the furnace has been covered with a thick layer of pulverized and wasted coal after two seasons firing.

The bunker also serves to give a check on fuel consumption if the stoker draws a chalk line in front of the bunker at the first filling and crosses it at the second filling. A repetition of this process will produce a series of crosses each representing one ton of coal.

Finally, the bunker provides a hard surface for shovelling and thus prevents the addition of sand and earth to the fire with the coal.

Clinker Pit. A clinker pit should be provided and situated about 12 feet behind the stoker's position. He can then throw the clinker into it without moving.

The provision of this pit prevents clinker being returned to the fire with the fresh coal and also helps to protect the native stoker against the danger of burning his feet on scattered clinker. Bad burns have been caused in this way, and such injury tends to make the native slow at firing up, to the detriment of efficient working of the furnace.

Shovelling Plate. A shovelling plate should be provided in front of the furnace. This can be made by laying down a brick course level with the ground. It enables ash and clinker to be picked up easily with the shovel. It is especially necessary during the rainy season.

Hosepipe. It is a distinct advantage to provide a hosepipe for filling the ashpit with water. The hosepipe should be fitted with a tap at the end nearest the barns and should be of sufficient length to enable it to be kept well clear of the shovelling plates. Natives often tend to be slack in filling the ashpits when a water can has to be carried some distance.

STARTING THE FIRE

First remove a brick from the base of the chimney so that it is possible to build a fire of brushwood there, for the purpose of creating a draught. This fire, which is lit later in the proceedings, is for the purpose of warming up the flue pipe; the chimney will not draw properly through a cold flue pipe.

Then spread an even layer of coal all over the grate (see Fig. 1) to a depth of not more than 2 inches and preferably just one knob thick.

Next build a small pyramid composed of short dry sticks at the mouth of the furnace (Fig. 3). Light this pyramid and cover it with medium-sized knobs of coal and then light the brushwood fire in the base of the chimney. Then push the furnace door too, leaving an opening of about 1 inch.

When the fire begins to burn up place more knobs of coal on the pyramid and then gradually extend the coal across the front of the door as shown in Fig. 2.

It is imperative not to leave an opening at the side as shown in Fig. 4. Such an opening allows cold air to enter which

does not penetrate through the coal and can therefore cause a drop in temperature.

When the furnace is drawing well, replace the brick initially removed from the chimney and make good with dagga, so that the fire can spread to the base of the chimney. When replacing the loose brick in the chimney leave it projecting about one inch to leave a ledge to facilitate the application of dagga for making good leaks. Leaks in the chimney are just as detrimental to efficient working as flue leaks.

It has been found that with tuition the native stoker becomes adept at carrying out the schedule outlined above, perhaps due to the fact that he can add the coal by hand. Expert stokers build the fire at the back of the furnace, against the baffle; but it has been found impossible to train natives to serve the fire by this method.

MAINTAINING THE FIRE AND CONTROLLING THE BARN TEMPERATURE.

The Banked Fire. The carrying out of the simple scheme just described produces what is known as a banked fire. The main object of this construction is to make as much of the air admitted as possible pass through the coal. The banked fire method has been worked out for producing low barn temperatures. The furnace has been designed to produce a barn temperature of 180°F. and when the required temperatures are only 90°F. to 100°F. these are obtained by the construction of the fire. The appearance of the furnace opening with the whole front full of glowing coal is shown in Fig. 2.

When the fire is burning well, the flue system must be tested by placing a piece of a plate or slate over the top of the chimney; leaks will then be clearly indicated by issuing smoke. These leaks must be sealed with dagga until the whole system is leak-proof. The barn is then ready for loading.

Important Details with the Banked Fire. The ash pit door and the air shutter controlling the air supply slots in this door must be kept closed. The steel tray must be in place over the top of the furnace. The furnace door must not be left wide open after putting on coal or the temperature will fall. Finally, ashes must not be allowed to accumulate.

OBTAINING BARN TEMPERATURES UP TO 110°F.

Barn temperatures up to 110°F. can be obtained, with maximum economy of fuel, by using the banked fire. The temperature is then controlled by the degree of opening of the furnace door. An important point to remember is that opening the furnace door too wide will have the same effect as not opening it enough; in each case the barn temperature will fall.

For tempartures up to 95°F. the maximum door opening required is not more than 1 inch and for the T.R.B. furnace about ½ inch opening is sufficient. If the temperature rises too quickly the door must be closed very gradually, not more than a quarter of an inch at a time, until the required temperature is obtained. The minimum closure, however, should not be less than about

the thickness of a penny; if the door is completely shut the fire will die down. When the correct opening has been determined, the native stoker should be instructed to close it to the correct position each time after adding coal.

A good indication of the correct door opening is given by the colour of the smoke. If the door is not sufficiently open the smoke will be black and if the door is too wide open the fire will burn rapidly, the chimney will be clear, and there may even be a little white smoke. The correct opening is indicated by a light brown haze.

BARN TEMPERATURE OVER 110°F.

Temperatures higher than about 110°F. cannot be obtained with the banked fire, and when higher temperatures are required it becomes necessary to spread the fire.

PROCEDURE FOR SPREADING FIRE

See that the ash pit door is closed and open the air regulating shutter slightly; an opening about the thickness of a penny is adequate. Then take the rake and with the blade downwards insert it above and behind the pyramid of coals and then force the handle of the rake downwards through the pyramid until the blade touches the grate. Next, push the rake back until it touches the baffle wall and then keeping pressure on the handle, pull it forward about one-sixteenth of an inch so that the fire bars are exposed (see Fig. 7). Then withdraw the rake and with the blade upwards push the pile of blazing coals into the cleared space. Then level the burning coal gently with deft touches of the rake. Now close the furnace door and open wide the ash pit door. Clear the ash pit with the rake and fill the ashcan with water. The latter detail is most important as it helps greatly to preserve the fire bars.

Allow the fire to burn up and watch the temperature closely. As soon as the temperature begins to rise, close the ashpit door and regulate the temperature by adjusting the air shutter on the ashpit door. This air shutter must never be completely closed and the minimum opening should not be less than the thickness of a penny.

If the temperature continues to rise when the air shutter is only very slightly open, its rise can be checked by opening the furnace door. This procedure is, however, wasteful of fuel and should not be necessary if the fire is correctly stoked.

COKING STOKING

It is often well nigh impossible to instruct the native stoker to add one shovelful of coal to the fire at a time or to educate him to fill holes in the fire with a shovelful of coal. In this case it will be fund best to adopt the procedure known as "coking-stoking." The method is as follows:—First push the coal back on the fire bars for about 3 inches with the rake and fill the space so formed with a new charge of coal (Fig. 8). Not less than one shovelful of coal and not more than two should be added at a time.

If the fire burns thin at the baffle end of the fire bars, instruct the stoker to take the devil, insert it and push the heap of coal in the front back to fill the hole (Fig 9).

Next use the devil turned prongs downward and draw it gently through the fire to break up any masses of coal. Some types of coal especially tend to bind together and restrict the necessary air flow through the fire.

Finally, level off the fire using the devil with prongs upward; make a space in the front of the grate and add a fresh charge, one shovelful at a time.

Using this "coking stoking" procedure, the native stoker is not liable to fill the whole grate with fresh coal.

Regulate the temperature using the air shutter in the ashpit door.

BARN TEMPERATURES ABOVE 130°F.

Barn temperatures over 130°F. cannot be attained merely by manipulation of the air shutter in the ashpit door. At this stage it becomes necessary to remove the ashpit door entirely and to regulate the temperature in the following manner. For example, suppose a barn temperature of 140°F. is required when the temperature is standing at 138°F. Place the devil prongs downward in the fire, shake the fire up and withdraw the ashpit.

When the barn temperature reaches 140°F. the opportunity should be taken to clean the fire. To do this, push the slice through to lift any clinker and remove this with either the devil or the rake, depending on the size of the clinker. Then level off the fire and add a fresh charge to the front of the furnace.

These operations entail leaving the furnace door open and are therefore liable to cause a drop in barn temperature. For this reason it is important to close the ashpit door before starting to remove clinker or indeed to carry out any lengthy operation on the fire. The air intake is then restricted as much as possible. Operations in which closure of the ashpit door is essential are shown in the diagrams.

With a spread fire the shutter in the ashpit door should always be open to at least the thickness of a penny. This prevents large temperature variations when cleaning operations are carried out as the temperature is rising and acts similarly if the fire is shaken up when the temperature is falling.

IMPORTANT POINTS IN FUELING THE FIRE OVERSTOKING AND HOLES IN THE FIRE

The T.R.B. Furnace should not be fired up excessively and 2½ inches thickness of fire is ample. Other types of furnace require 6 inches of fire, but the red hot flue this usually entails is indicative of a poor design.

Overstoking is a very common error. This error can, however, easily be guarded against if the following points are watched. The baffle should be white hot or almost incandescent in the T.R.B. furnace when it it is working at full pressure. The coal should burn red to white, and should burn evenly, leaving no

holes in the fire. The underside of the arch should be white hot, and if the underside of the firebars are observed through the ashpit door the coals should appear bright red. Black patches on the grate show that clinker is present and this should be removed at once.

It is most important not to allow holes to form in the fire, as these cause a blowpipe effect and the intense local heat thus generated buckles and bends the fire bars. This not only causes the fire bars to wear rapidly, but also causes uneven barn temperatures.

THE SMOKE AS A GUIDE TO CORRECT WORKING

It is a good policy to make a practice of watching the smoke from the chimneys as this gives a very good indication of correct stoking. Thus, white smoke indicates too much air, which may be caused by (a) thin fires with holes, (b) too wide an aperture of the ashpit door, or (c) a dropped fire bar. Black smoke, in turn, indicates not enough air. This may be caused by (a) too thick a fire, (b) a grate choked with clinker, (c) the complete closure of the shutter on the ashpit door, or (d) leaks in the flues or in the chimney.

When the fire is burning correctly the smoke should be light brown in colour.

DEALING WITH A DROPPED FIRE BAR

A dropped firebar is usually caused by either lack of water in the ashpit or by holes in the fire. Excessive heat has then made the bar buckle so that it becomes too short for the supports. This contingency usually occurs during the period of maximum demand on the furnace and can be serious and cause colour run-back in the leaf unless quickly remedied. The procedure for dealing with a dropped firebar is described below.

Close the ashpit door and air slide and then clear away the coals from the position of the dropped firebar with the rake. Then place a brick on edge in the devil and balance the brick along the handle. This is not difficult but needs a little practice and a steady hand (Fig. 10). Then insert the devil into the furnace so that the handle is just parallel with the edge of the space left by the dropped firebar. When the brick is close to the baffle turn the handle of the devil so that the brick drops on its edge into the space. Then push this brick up to the baffle and drop four more bricks into position and finally a half-brick for the front.

Level off the fire, stoke up, close the furnace door, clear the ashpit and open the ashpit door wide. The trouble is then remedied. The whole operation can be carried out in two minutes and an undue drop in temperature is prevented.

Conclusion. If these few simple operations described in this article are carried out and the proper tools are provided for the stoker no difficulty should be experienced with the coal furnace. Moreover fuel consumption will be at a minimum and an efficient performance from the furnace assured.

Tobacco Research Board

Introduction and Short Summary of Annual Report for 1947/48 Season

INTRODUCTION.

1. Preliminary.
2. Significance of statistical results.
3. Past results in rotation three year, five year, and grasses.
4. Fertiliser Practice. (a) Fractional application.
   (b) Amount.
   (c) N.P. Balance.
5. Spacing results.
6. Use of compost.
7. Gammexane.
8. Root Knot Nematode.
9. Time of Ploughing.
10. Breeding and Varieties.

Preliminary. The Annual Report of the Tobacco Research Station at Trelawney has to serve two purposes. It is a technical record of work done and it is also circulated for the information of farmers.

To serve those two purposes better, the Report has been divided into two parts. The Introduction gives a short account of previous work connected with each of the experiments carried out this year and also briefly summarises the results of this season's work. The second part follows the lines of previous reports and gives a more detailed and technical account of each experiment.

SIGNIFICANCE OF STATISTICAL RESULTS

No two tobacco plants or groups of plants are identical and variations due to soil, hereditary characteristics, climate and cultural practices are inevitable. The technique of agricultural plot experiments is designed to determine whether a variation found in a crop is due to chance or to conditions deliberately imposed on the crop.

If a field of tobacco is divided into a number of equal size plots and the weight of tobacco from each plot is recorded a variation from plot to plot will be found. The average yield per plot can be calculated and in a uniform field with uniform plants

the differences from the average yield will be small. A measure of the degree of variation or uniformity is known as the Standard Error and this figure is quoted for each experiment described in the Annual Reports. The figure can be expressed either as a percentage of the yield or as a variation of the yield in lb. per acre. The smaller the variation and standard error, the more accurate the experiment and the smaller the differences which can be demonstrated.

In practice a number of "treatments" are repeated several times. A set of treatments can be produced by varying the variety grown, a cultural practice or fertiliser application. Thus, in a land with 72 plots we may have 12 different varieties with six plots of each variety. A standard error can be found for the average yield of each variety. Suppose the standard error is found to be 3.5 per cent. of the mean yield. If all the varieties were identical and the experiment were repeated many times, under the same conditions, it would be found that the difference between the largest and smallest yield would exceed 10.2 per cent. only once in 20 experiments and the difference would only exceed 13.4 per cent. once in 100 times. This statement can be made because a large number of random variations of any measurable characteristic almost invariably follows a particular mathematical form. Thus in the experiment, if we find a difference between two variations of 10.2 per cent. the odds against the variation being due to chance are 1 in 20. Similarly, if we find a difference of 13.4 per cent. the odds are 1 in 100. These differences are calculated for each experiment detailed in the Annual Reports and are known as differences significant at the 5 per cent. point (1 in 20) and of the 1 per cent. point (1 in 100).

If a significant difference is found it is a strong indication of an effect on the crop which is not due to chance but due to the treatment or to some condition associated with the treatment. As far as possible conditions are kept identical for each treatment but it is occasionally extremely difficult to avoid conditions associated with a treatment influencing the result. For instance, an extra vigorous variety may grow more quickly in the seed beds and be unsuitable for planting out at a time when the rest of the varieties in the experiment are ready. Again in a spacing experiment plants ripen at different rates and natives reaping have a strong tendency to take the same number of leaves from each plant. Perhaps soil conditions or weather may suit a particular variety more than others, and to obtain a definite decision on any point it is necessary to run experiments for several years to eliminate as far as possible unknown variables and freak results.

A further point is that although a significant difference is a strong indication that the treatment has produced some effect, the lack of a significant difference merely means that differences due to treatments are smaller than the significant difference, and the treatment differences may be negligible or quite considerable, but the experimental conditions have been such that they cannot be demonstrated. Under Station conditions the yield significant difference is about 13 per cent. (±2 per cent.). Thus if treat-

ments or varieties tested give a difference of less than about 13 per cent. it is extremely difficult, in practice, to demonstrate the difference between them.

If, however, a significant difference is found for several years running, the difference is, beyond all reasonable doubt, not due to chance.

CROP ROTATIONS.

Seven different three year rotations and seven different five-year rotations have been under way since 1941. The general inferences so far are:—

1. A three-year rotation is too short to allow the land to regain condition after tobacco.

2. Grass cover crops on the whole give best results, although dahl did well in some five-year rotations.

3. Sunn hemp has a marked bad effect on the following tobacco crop.

4. On the whole a legume crop should not immediately precede tobacco, although in some cases tobacco following dahl or velvet beans has done quite well.

In view of the usefulness of grass, a series of plots has been laid down of different types of grass to determine the effect on succeeding crops of tobacco.

FERTILISER TRIALS.

(1) **Method of Application:**

It has been shown that in wet years fractional application of fertiliser is much more effective than a single application. In seasons of low rainfall the difference between fractional and single application is much less. The Research Station practice is to apply the fertiliser in three roughly equal parts, first in the hill before planting and then with further applications two weeks and five weeks after planting. The amount of the second and third application is adjusted according to the appearance of the crop and in wet seasons additional nitrate is used.

(2) **Amount of Fertiliser Elements required:**

The following general conclusions have emerged:

(1) Maximum increases in yield and value can only be obtained when nitrogen and phosphate are applied together. Thus the increase in yield due to a combination of nitrogen and phosphate is greater than the increases due to both applied separately.

(2) Excess nitrogen is known to reduce quality and encourage spot. On the grey sand soil which constitutes the major part of the Station, the optimum rate of application of nitrogen was found to be rather more than 36 lbs. per acre in five experiments and between 27 lbs. and 36 lbs.

per acre for three experiments. This corresponds to the nitrogen in 450 lbs. to 600 lbs. per acre of 6:10:8 fertiliser (NPK).

(3) The phosphate required to balance the nitrogen varied between ½ and 1½ times the amount of nitrogen. The standard 6: 10: 8 NPK formulation used this last season would therefore cover the majority of cases, as a surplus of phosphate does not do any damage to the crop. In one experiment in the 1946/7 season, however, the increase in yield due to the use of compost was found to be due to the compost increasing the available phosphate, indicating in that particular case that the standard 6: 10: 8 formulation supplied insufficient phosphate. Further an analysis of 26 random samples from the auction floor from 1946/7 crop indicated a phosphate shortage in a small minority of cases. Thus it is evident that the phosphate requirements vary widely and the increased amount in the 1948/9 season fertiliser (6:12:8) should be of considerable benefit to a few growers, but will only have a small effect in the majority of cases.

(4) There is a certain amount of pink sandy soil on the Station which is somewhat heavier than the grey sandy soil derived from granite.

No comprehensive NPK trials have been run on this type of soil until this last season, but the fertiliser requirements have in general been found to be about half the amount required on the grey sandy soils. This year's experiments indicated an optimum nitrogen application of about 18 lbs. per acre (300 lbs. 6:10:8), and that the amount of phosphate in the fertiliser was quite adequate to balance the nitrogen.

As far as the supply of nitrogen is concerned, the foregoing conclusions are in reasonable agreement with American recommendations for light soils which support the application of 24 lbs. to 36 lbs. of nitrogen per acre. For more productive soils, however, the nitrogen should not exceed 30 lbs. per acre, according to American views, but for Rhodesian conditions on more productive soil the figure 24-30 lbs. per acre seems somewhat too high. These conditions, however, probably correspond to conditions under which American tobacco becomes rough and of poor quality, where it is recommended that the nitrogen should be reduced to 16 to 20 lbs. per acre, which is in agreement with Station findings for more productive soils.

American recommendations for the application of phosphate are from 72 to 120 lbs. per acre for light soils and 72 to 100 lbs. per acre for more productive soils. This is at least half as much again as the necessary maximum indicated by experiments on the Station.

Potash Requirements, to produce maximum yield, have been found to vary between less than the equivalent amount of nitrogen and 1½ times as much. In no case was there any significant increase in price (as opposed to yield) with increased applications

of potash except in this year's experiment, however, on pink sand soil, increasing the amount of potash gave a small increase in the amount of the brighter grades. American recommendations give from 100 to 144 lbs. K_2O per acre, which is over twice as much as the largest amount found to be useful on the types of soil on the Station.

Chloride Poisoning was found one year when the amount of potash as muriate (or chloride) was increased from 48 to 64 lbs. per acre, and a drop in yield for the larger amount of potash resulted. The following two years 64 lbs. of muriate had no apparent ill effects. Official American sources recommend limiting potash applied as muriate to 27 lbs. per acre on acid soils (pH less than 5.6) and 40 lbs. on other soils (i.e., equivalent to 350 and 500 lbs. 6:10:8). Thus the maximum amount of potash which can be safely applied as muriate is about 30 lbs. to 40 lbs. per acre, corresponding to 380 to 500 lbs. per acre 10:6:8 fertiliser with all the potash present as muriate. This year's seed beds were slightly affected by chloride poisoning, but in the coming season the supplies of sulphate of potash should be better and the problem should cease to be a practical one in the lands. American experiments, however, have shown that a certain amount of chloride in tobacco increases its value, and the inclusion of a certain amount of muriate is therefore all to the good, except perhaps in seed bed fertiliser, which according to American recommendations should be free from chloride. Chloride poisoning in seed beds is shown by the edges of leaves curling upwards and the whole leaf becoming smooth and glabrous. We should be very interested to receive samples of leaves suspected of chloride poisoning.

Spacing Trials:

For three consecutive years beginning in 1944, spacing trials were carried out comparing 3 ft. by 3 ft., 3 ft. by 2 ft., 3ft. 6 ins. by 2 ft., and 4 ft. by 2 ft. spacing of plants. It was found that considerable increases of yield resulted from the close spacings. The higher the number of plants per acre, the greater the yield, but the increases in yield were not proportionate to the number of plants. Spacing at 3 ft. by 2 ft. requires a 17 per cent. increase in the number of plants compared to 3 ft. 6 ins. by 2 ft. spacing, but the average increase in yield and value over three years was only 2 per cent. Closer spacing had only a slight effect on quality. tending to increase the proportion of short leaves and fine down the leaves, producing a higher proportion of brighter leaf in seasons of rank growth. On the grey sand soils of the Station on which these trials were carried out, it is thus apparent that the optimum spacing is about 3 ft. 6 ins. by 2 ft. (equivalent to 6,200 plants per acre).

This season, an experiment was carried out on slightly heavier pink sand soil, with spacings at 3 ft. by 1 ft. 6 ins., 3 ft. by 2 ft., 3 ft. by 3 ft., 4 ft. by 1 ft., 4 ft. by 1 ft. 6 ins., and 4 ft. by 2 ft. to determine whether closer spacing was better on the heavier type of soil.

The 3 ft. by 1 ft. 6 ins. plots gave a 29 per cent. increase in yield over 3 ft. by 2 ft. plots, for the 33 per cent. increase in the

number of plants, demonstrating that the optimum spacing for yield is much closer on heavier pink sand soil. It was also apparent that 1 ft. spacing is too close, as the 4 ft. by 1 ft. spacing with more plants per acre than 5 ft. by 1 ft. 6 in. gave a smaller yield.

The closer spacings, 3 ft. by 1 ft. 6 ins. and 4 ft. by 1 ft., produced a significantly lower proportion of bright leaves and a nearly significant higher proportion of low grade spotted and sponged leaves, indicating that the limiting factor in closing up plants on the pink sand soil under consideration is the incidence of spot, which increased significantly from 3 ft. by 2 ft. to 3 ft. by 1 ft. 6 ins., and from 4 ft. by 1 ft.6 ins. to 4 ft. by 1 ft. This is in contrast to the results on lighter soil, where the limiting factor is the decreasing yield return on the number of plants used.

Closer spacing definitely produced earlier ripening of leaf and all plots were reaped on the same day. Although every effort was made to pick leaves of the same degree of ripeness, it is quite possible that leaves from the closer spacings were generally riper than the remainder, which in itself would encourage spot and sponging. While there is therefore a strong indication that decreasing spacing from 7,300 plants per acre to about 10,000 plants per acre (i.e., 3 ft. by 2 ft. to 3 ft. by 1 ft. 6 ins.) results in an increase in spot, the result must be confirmed by repetition of the experiment.

Apart from the effect on the incidence of spot, closing the spacing tends to produce thinner leaf and shorter leaf. The 4 ft. spacings seem to emphasise more the shortening effect, while the 3 ft. spacings produce much thinner grades and less shoots.

Gammexane:

Trials with Gammexane and DDT were commenced at Trelawney Tobacco Research Station in 1945 by Mitchell and carried on in the following year by Moffett (R.A.J., March, 1948). At first, the effectiveness of the various treatments was estimated from the number of insects killed. It was shown later, however, that the number of insects killed was not a reliable measure of effectiveness and it was necessary to count the number of plants failing to survive and determine the cause of failure of each plant.

The trials so far have demonstrated the following points:—

(1) Gammexane has proved to be a very effective insecticide for the control of both white grubs and false wire worms in tobacco lands.

(2) Gammexane may be applied immediately before planting or several weeks before, and is effective either broadcast or applied as local dressings round the plant. The relative merits of the two methods of application have not been fully determined.

(3) The maximum effect is only obtained from applications which are too expensive for commercial use. A dressing of 25 lbs. per acre of 0.5 per cent. Gammexane dust

(present cost about 1s. per pound) reduced the loss due to underground attack by insects to amounts ranging from 14 per cent. to 30 per cent. of the loss on untreated ground. This treatment followed by Gammexane treatment at the same rate of refilled hills should give a good stand at reasonable cost.

(4) Gammexane may be used effectively to treat hills where plants are missing before refilling.

(5) The insecticide proved ineffective against crickets. The attack of cutworms was not sufficiently high to draw any conclusions.

(6) The larger applications of Gammexane applied in the 1946-1947 season had a residual effect in the 1947-1948 season, the heavier applications giving a high degree of control of wire worms and white grubs.

(7) Tobacco grown on soil treated with 200 lbs. per acre, 0.5 per cent. Gammexane was examined and no taint in the aroma could be detected. There is therefore very little possibility of taint developing from commercial applications of about 25 lbs. per acre.

The Use of Compost:

The questions as to whether applications of compost to flue-cured tobacco produce a worth-while effect has given rise to considerable discussion and controversy in this country. Reports from growers have been contradictory, some claiming to have striking increases in yield and quality, while others say they have no noticeable effects.

Compost on tobacco lands has been tested on this Station every year since 1939 and although results have been variable, the following facts had been established or indicated at the beginning of 1947 season:—

(1) Compost may have no effect whatever, but in general, either yield or quality or both are improved. Yield increases vary from 0 to 40 per cent.

(2) Yield increases tend to be larger on older land with larger applications of compost, and within limits with larger applications of fertiliser.

(3) Yield increases depend to a certain extent on the type of compost, but to an even greater extent on other factors, such as soil or weather conditions.

(4) The method of application of compost makes very little difference to its effect. Compost was broadcast early and late and also applied immediately round the plant. No treatment produced results different from the rest.

(5) The degree of breakdown of compost seems to be relatively unimportant as long as the carbon nitrogen ratio is sufficiently low. This ratio decreases as compost matures, but compost may be well broken down and still

be a very poor source of nitrogen, and in some cases compost actually reduces the amount of nitrogen available to the tobacco.

(6) Compost has no effect on the rate of infestation by nematode.

(7) In one experiment early application of compost increased the white grub population, while later applications did not, due to the earlier applications attracting egg-laying beetles.

(8) Compost on seed beds tends to produce a large number of weeds. Five composts from various sources were found to contain 45,000 to 146,000 viable weed seeds per ton.

(9) Last season's increase in yield from five different composts was found to be closely associated with the increased phosphate supplied by compost. This cannot be expected to be a general result as usually there is more than enough phosphate in fertiliser to balance the nitrogen available to the plant.

This season four separate experiments were carried out using compost. Last year's work using different types of compost was continued. The residual effect from last season's applications of compost was determined. Compost was applied to land which had been split into plots and had carried a varying number of crops of tobacco. Lastly, compost was applied to plots which had carried seven different crop rotations.

Increases in yield of from 8 per cent. to 11 per cent. were obtained by the use of different types of compost. One of the larger increases was produced by compost made with "Adco" without the use of animal wastes, showing that increases in yield are not due to heteroauxines or similar substances in animal wastes.

When allowance had been made for the variable stand in the experiment on residual effect, yield increases due to last year's applications of 5 different types of compost varied from 6 per cent to 13 per cent., although only two of the increases were statistically significant at the 5 per cent. point. There were corresponding increases in value, four of which were significant, showing that the value of one application of compost extends to the following season. Tobacco grown on compost alone without addition of fertiliser impoverishes the soil to such an extent that the compost has no residual effect whatever.

Compost was found to have an increased effect, the larger the number of crops of tobacco the land has carried. Yield increases (adjusted for stand) were found to be 42 per cent., 39 per cent., 34 per cent., and 21 per cent. on third year ploughed very early, second year ploughed very late, second and first year land respectively, confirming indications obtained previously that the greater effects of compost are obtained on older land. Even on new land, however, considerable yield increases are possible. In this experiment, the amount of organic matter in the soil was

measured and it was found that applications of compost at 5 tons per acre are not nearly sufficient to maintain the organic matter content of the soil at a level equivalent to new land. Of the two tons per acre of actual organic matter applied as compost only one-third of the amount is left at the end of the growing season, and the loss due to cultivation is about 2.8 tons per acre for the first year of cultivation. Thus the application of compost only makes up for about a quarter of the organic matter loss in the first year of cultivation. In spite of this, in this particular experiment, compost very substantially reduced the loss in yield due to two successive previous crops of tobacco. Allowing for the fortuitously low stand in the first year land, the yield per acre was greater on third year composted land than first year uncomposted land.

The plots in one of the five-year rotations were divided equally into composted and non-composted parts. There were several different types of rotations and seven plots of each type. Compost produced an increase in yield in every case but the responses varied from 2.6 per cent. to 25 per cent. increase in yield, most of the smaller increases being not significant statistically. This experiment shows that the response to compost is primarily governed by the condition of the soil, as the same compost, under the same conditions on one piece of soil treated in different ways produced widely differing results. The three larger yield increases were from the three rotations giving the poorest yields and values, showing that compost supplied some fertilising principle which these rotations failed to produce in the soil.

It would therefore appear that the response to compost depends primarily upon the condition of the soil and the number of successive crops of tobacco it has carried. To a secondary extent the nature of the compost has an effect, the availability of nitrogen in the compost probably being an important factor in many cases.

The only practical application of this information is to apply compost to small experimental plots of first year land and if a response is observed the following crop will derive even greater benefits. If no response is observed, the application of compost the following season is again likely to produce a small result or none at all.

Root Knot Nematode:

Work on root nematode has proceeded for several years but is now very much reduced for lack of an entomologist.

A long list of hosts of the pests was included in the 1942 and 1943 Reports. There are so many plants which harbour root knot nematode that it will persist almost indefinitely in soil which is under weed fallow, or natural conditions. For a grass ley to be successful in suppressing nematode it must exclude all weeds. Weed fallow is not an effective means of suppressing eelworm.

A study of the distribution of nematode infestation in the soil revealed that the heat of the sun renders the top two inches of soil practically free from nematode at the end of the dry season, but that infestation is heavy down to the lowest depth studied (12 inches). When the rains come the nematode population moves upwards. Thus any chemical treatment of lands has little hope of entirely eliminating nematode. It may, however, be possible to delay attack until such time as tobacco is firmly established. It is also possible to give the plants a good start by gathering the top two inches of soil into hills for each plant as suggested by A. P. Collins (R.A.J., June, 1938).

Various chemical treatments have been tried in an attempt to reduce nematode attack, but no success was achieved. Cyanamide was tried this season, but with no result.

Attempts to breed eelworm resistant varieties which also produce good quality leaf were unsuccessful, but fresh strains are being tried out this coming season.

The effect from various rotations on the nematode population has been determined. Ground nuts (Bunch) and cotton (9L34) seem to be almost as effective as bare fallow in reducing nematode, and the inclusion of one or other of these crops in the rotation on heavily infested land is indicated. Cotton appears to have the better effect on quality and yield and should therefore be the more suitable crop immediately to precede tobacco. On most lands the principle of interposing a cereal between a legume and tobacco should be adhered to.

Time of Ploughing:

It was observed that the bulk of the eggs which hatched white grubs were laid before November 19th in the 1945 season, and on the basis of this observation it was hoped that the white grub population could be reduced by delaying ploughing until after egg laying was finished.

Two successive experiments on these lines failed to produce statistically significant results although the trend was in favour of late ploughing. This season ploughing was delayed until November, but the resulting stand was poorer than in neighbouring plots ploughed earlier. Owing to shortage of staff it was not possible to determine the cause of the poor stand.

Breeding and Varieties:

The breeding work on this station since 1940 has been divided into four parts:—

(1) Selection of plants from well known varieties in an attempt to improve field characteristics and curing qualities.

(2) Trials on imported varieties.

(3) Breeding for resistance to eelworm and mosaic attack.

(4) Selections from crosses between varieties.

The trials on the usual varieties and seed selection from the trials have resulted in a big improvement in the strains particularly of Bonanza. Owing to the difference in vigour, however, very few consistent results have been obtained, with the notable exception of Gold Dollar. This is a variety lacking in vigour, which, however, is more satisfactory than most on heavier soils, but has given poor yields on the light soils of this station.

Jamaica Wrapper is perhaps the most vigorous of the varieties grown, but it is inclined to rank growth on heavier soils.

Bonanza, being not quite as vigorous, can be grown on a wider range of soils. Willow Leaf is a very similar variety. Yellow Mammoth has given consistently good quality leaf.

The trials carried out on imported varieties have so far produced nothing better than our station strains of Bonanza and Jamaica Wrapper.

Breeding for eelworm and mosaic resistance has so far been unsuccessful but it is hoped to try some imported eelworm resistant strains of tobacco this season. Breeding for disease resistance usually means sacrificing some other characteristic, usually quality, and as mosaic can be controlled by other means, there seems little reason to carry on with this work.

The crossing of varieties of tobacco in attempts to breed disease resistant and improved strains has been made more difficult by the fact that the ovaries of the plant even if not pollinated are capable of producing some viable seed.

As a result the seed obtained from a plant which has been fertilised by pollen from another variety contains many seeds which are not crosses. Unless there is a very noticeable difference in the resulting hybrid it is almost impossible to select the required plants.

Two good strains have, however, been bred on this station. They are crosses between Jamaica Wrapper and Bonanza.

The first, C.7.46, besides good yields seems to produce good quality leaf. The second, C.10.46, is a good all round variety.

Small quantities of seed from these two strains have been distributed to farmers for commercial trial in the 1948-1949 season.

The breeding work in the 1948-1949 season is to be limited to trials on the common varieties, the two crosses bred on the station, a number of imported eelworm resistant varieties and perhaps one or more of the better imported varieties.

Sawmills

By G. R. CAMERON, Forestry Division.

The following notes may be of some benefit to anyone operating a bush sawmill or to a farmer who runs a sawbench solely for farm use.

In any sawmill careful attention should be paid to power transmission, saw speed and maintenance and correct "lead" for the breakdown saw, otherwise the efficiency of the plant will be seriously affected.

These points are dealt with in detail below.

Power Transmission. No matter how great the power of the prime mover, only as much power as the pulleys and belting can transmit wlll reach the saws. Power transmission losses cannot altogether be eliminated, but the maximum efficiency can be obtained by correct alignment and spacing of pulleys and the use of proper belting, periodically maintenanced. The slip of a belt varies according to its grip on the pulley, and when there are several successive transmissions the aggregate slip may be considerable and so alter the requisite speed of the saw. The liability of a belt to slip is, however, the very circumstance which renders this kind of transmission preferable to direct drive. Thus, if the timber be fed into the saw too rapidly and then binds on the saw, some part of the apparatus must yield or break, and the belt slipping on the pulley affords the necessary relief. Excessive slip will polish the belt surface and so aggravate the trouble. A shiny appearance on the pulley will indicate belt slippage which may be due to running belting too loose, too great a load or too small a driving pulley. Vee belting also yields by slipping.

Quite a good guide to determine the horsepower required to drive various sized saws is given in the formula below.

Approximate H.P. = $\frac{(\text{diameter of saw})^2}{40}$, thus 18″ saw would require about 8 H.P. and a 48″ saw would require about 58 H.P.

Pulleys. Pulleys must have sufficient girth and belts be of sufficient width to provide the necessary traction area. If, however, the pulleys are too large the belt velocity may become so great that a large percentage of the power is wasted because centrifugal force will reduce the tension between belt and pulley.

Pulleys should be placed in such a way that the slack half of the belt is uppermost. To ensure this, shafting and pulleys should be so arranged that the lower half of the belt will travel towards the bottom of the driving pulley.

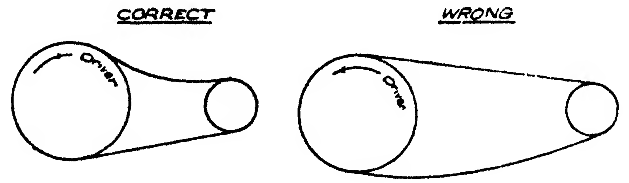


FIG. 1.

The ratio of diameters of mated pulleys should not exceed 5 to 1, and their distance apart should enable the belt to make an arc of contact of at least 160° on the smaller pulley; it follows, therefore, that the distance between pulleys should be increased as the ratio between their respective diameters is increased. For instance, if two opposite pulleys have diameters in the ratio of 2 to 1, their distance apart should not be less than 8 feet, but if the ratio should be 5 to 1 their distance apart should not be less than 15 feet. If the arc of contact is less than 160°, power will be lost—at 120° the loss is 25 per cent.

To find the arc of Contact. Divide the difference between the radii of the two pulleys, in inches, by the distance between their centres, also in inches, and multiply the result by 115; this subtracted from 180 will give the arc of contact of belt on the smaller pulley given in degrees.

To eliminate to a large extent the terrific pressure on bearings, belt slippage, and long distance between centres, a jockey pulley can be employed. This pulley, suspended on a swinging frame, can, by means of a lever, be lifted free of the running belt if necessary, and it affords an easy method of stopping and starting machines. The use of a jockey pulley, too, makes efficient vertical drives possible.

Large fast moving pulleys should be properly balanced.

The two functions of pulleys are, to transmit power and to give off that power at the requisite speed. In some cases the power has to be transmitted at an angle to the driving pulley, but if the power has to be carried direct from one pulley to another, in order, for instance, to increase or decrease the speed, then the two shafts must be made truly parallel and the pulleys directly opposite.

If the shafts be parallel and the pulleys not directly opposite, then the belt will move over to one side of the larger pulley when running.

If the pulleys be directly opposite but the shafts not be truly parallel, then the belt will move over to one side of the smaller pulley when running.

A belt under load will incline to run to the largest diameter of the pulley, hence by making the centre of the pulley face higher (crowning) the belt will run towards the centre.

Pulleys should be a little wider than the belt.

Vee Pulleys. Sheaves should be kept scrupulously clean. Belt dressing should never be applied, as it will pull the outer covers off the belts. If the belts slip, it is an indication that more belts and grooves are required. Jockey pulleys should not be employed on vee belting.

Speed of Pulleys. The numbers of revolutions of two connected pulleys are inversely proportional to their diameters. Thus:—

Revs. of first pulley : revs. of 2nd pulley =
diam. of second pulley : diam. of first pulley.

Flat Belts. When a belt is placed over two pulleys, the tension is the same on both sides of the belt, but as soon as the driver commences revolving, the belt on the bottom side is pulled taut and a difference of tension between the upper and lower sides takes place, and it is this difference of tension which makes possible the transmission of power. It follows, therefore, that the tight side, by its elasticity, becomes thinner, due to the pull until the tension is removed as it reaches the top of the driving pulley, where it will contract and become thicker. This condition makes the belt creep ahead of the driven pulley, and if too great a load is attempted it will cause the belt to be thrown completely off its pulleys and possibly do a great deal of damage. Belting should therefore be of sufficient thickness and width to carry the maximum load required of it.

Lubricating oil should never be allowed to come into contact with belting. If belt dressing is used it is liable to accumulate in lumps on the pulley faces and cause the belt to run to one side or the other. These lumps should be removed by scraping and the pulley face washed clean with petrol and powdered soapstone.

A steel square should be used when cutting belts, the cut being made with a sharp knife, the edge of which is moistened whilst cutting. The cut must be vertical and be truly at right angles to the belt and frayed ends must be cut clean.

If the underside of the belt becomes hard and glazed, apply boiled linseed oil with a brush.

The belt fasteners must not project over the edge of the belt.

The belt fasteners should be examined periodically and the pins in the hinged joints replaced if they show signs of wear.

Square edged belting is preferable to belting with rounded edges, as it is more flexible and has a greater wrapping effect round the pulleys. This is clearly demonstrable: if several layers of paper with open edges are wrapped round a cylinder they will at once conform to the shape of the cylinder, but if the top layer

of paper is wrapped right round, the edges will crinkle as it is laid over the cylinder.

Crossed Belts. Belts are crossed to reverse the motion of two shafts. This procedure is usually condemned because of the loss of power caused by friction and because the belts wear out more rapidly. If, by reversing a bench, production is enhanced it would certainly be more economical to do so, and crossed belts do not wear out rapidly at all; moreover, the increased arc of contact which a crossed belt makes with both pulleys will offset the loss of power caused by friction.

Vee Belting. Vee belting is definitely superior to flat belting for the small re-saw benches, especially if motor-driven where provision is given for stretching by mounting the motor on slide rails. The wedge-shaped belts running in sheaves of the same shape permit the use of very short centres between pulleys. The machines run more quietly and the whole drive can be completely boxed in.

One disadvantage is that if one of the belts breaks, all the belts have to be replaced so that they all have the same tension (they stretch about 4 per cent. in their lifetime).

Speed of Belts. As soon as a belt attains a speed of 3,000 feet per minute a liberal allowance for power loss due to centrifugal force must be made. According to the Dunlop Company a reduction of 20 per cent. must be made for a four-ply belt travelling at 5,000 feet per minute.

To ascertain the belt speed, multiply the pulley diameter in inches by the revolutions per minute of the same pulley and divide the result by 3.82. It will thus be seen that the belt speed is governed by the driving pulley.

Wide belting with large diametered pulleys should be aimed at, but the pulley size has to be limited to keep the belt velocity within 3,000 feet per minute if possible, and at the same time transmit the correct speed to the saw shaft.

Bearings. Saw benches are usually provided with ball or roller bearings. These should be washed out regularly with benzine and repacked with fresh grease, but not too tightly, or the bearings will heat up. Paraffin should *not* be used to wash out bearings as it causes rust.

The steel rings in the bearings to prevent movement of the shaft lengthwise should not be placed in the two terminal bearings of the line shaft, but should be placed in the two central bearings in order to allow free expansion of the shaft.

Oil-ways in brass and other soft-metalled bearings should be kept clean, and high spots, usually indicated by smearing red lead on the journal and turning the shaft by hand, should be scraped away. The bearing must not grip the shaft all round but should be scraped so that one-third of the surface is just free of the shaft at the area of the holding down bolts.

A little graphite mixed with the lubricating oil sometimes helps to keep this type of bearing cool.

Shafting. The shafting must be in proper alignment, otherwise power will be wasted in bending the shaft at every revolution, bearings will wear out rapidly, and belting run to one side and may even overlap the pulleys with a consequent further loss of power.

If the shaft whips when running, the pulleys are either out of balance or the bearings are spaced too far apart, or there is a combination of both these faults.

Pulleys, when running, subject the shaft to a great shearing stress, which is zero at the centre of the shaft and is greatest at its circumference. For long line shafts the following formula has been recommended:—

$$D^3 = \frac{125 \times \text{horse power}}{\text{number of revs per minute}}$$

where D = diameter of shaft.

This gives a diameter which is a little greater than that usually given in text books.

Speed of Saws. To ascertain approximately the rim speeds for available horse power the following formula is of use:—

$$Y = 2500 + 125X$$

where Y = peripheral speed and X = horse power.

It appears to be a recognised tenet in sawmilling practice that the peripheral speed of solid tooth saws and inserted tooth saws be about 10,000 and 8,000 feet per minute respectively.

These speeds seem to be quite all right for small re-saws where little power is consumed and comparatively small pulleys are in general use, but for the larger breakdown saws available horse power should, to a large extent, determine the speed.

Running a break-down saw at a rim speed of 10,000 feet per minute will greatly enhance efficiency provided a nice balance between pulley sizes exists, and provided that sufficient power is available to maintain that speed while the saw is actually cutting, as well as when it is running free of the load. If the belts wave and roll alarmingly and the engine labours and slows down appreciably whilst the saw is cutting, the speed should be reduced until it remains constant, both under and free of the load; the belts then, when the saw is cutting, instead of rolling wildly, will just tend to wrap themselves a little further around the pulleys.

Thus a rim speed of 10,000 feet per minute is advised for 60 H.P. but only 5,000 feet per minute would be suitable for 20 H.P.

It is not intended that this formula be rigidly adhered to, but it does show that horse power must be taken into account, and that saws should be tensioned and speeded accordingly.

It also follows that, as the efficiency of sawing is increased as the peripheral speed increases, which again increases as the power increases, ample power and efficient transmission are absolutely essential.

The foregoing applies particularly to saws breaking down logs in the round, but in the case of re-saws, where little power is required, peripheral speeds up to 14,000 feet per minute is not out of the ordinary. These speeds are made possible by recent improvements in saw steel manufacture and by using a suitable electric drive.

If a saw be run at a speed beyond that for which it was tensioned, the teeth will vibrate, there will be an insufficiency of loose metal in the body of the saw to take up the stretched rim, which will expand more than the central portion and so cause the saw to run crooked in the log. *The area just under the teeth will heat up rapidly.*

On the other hand, if a saw is running too slowly there will be a surplus of loose metal in the body of the saw bound by a tight rim, and the *area just around the collar will heat up rapidly.* In both cases saws must be retensioned; if possible this should be done by a competent saw doctor.

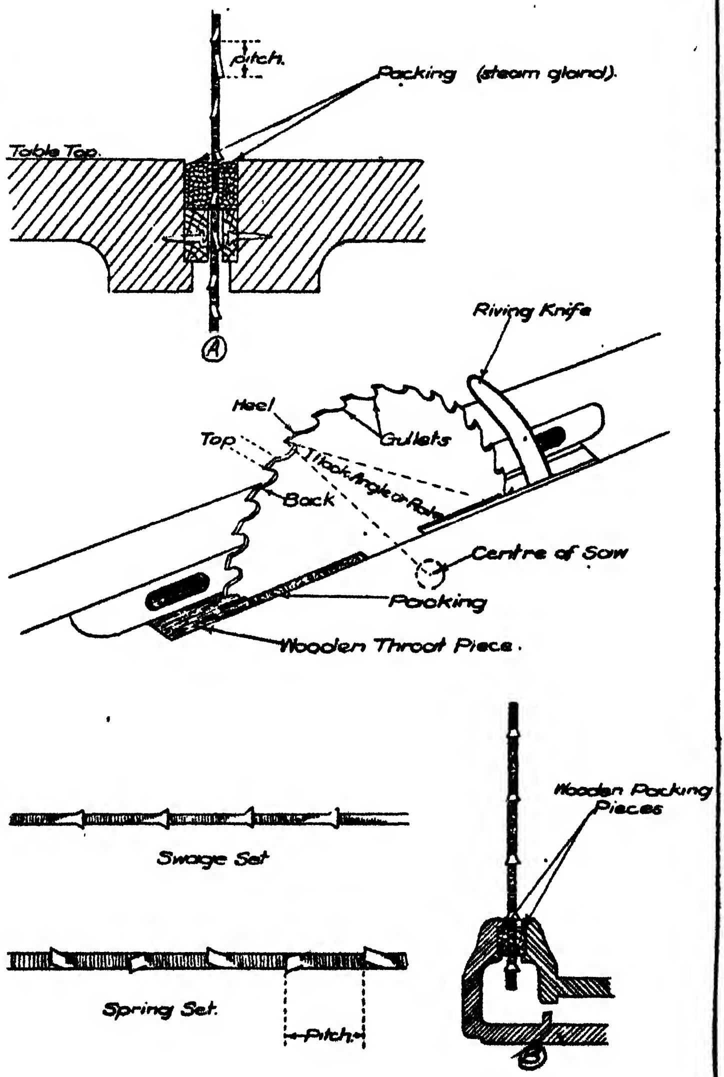
Saw Maintenance. To avoid excessive wastage in sawdust and too great consumption of power, saws have to be made as thin as possible but at the same time they must be able to stand great strains and continuous shocks. Furthermore, centrifugal force, acting on a thin circular saw, revolving at speed, would, by continuous oscillation, tend to fatigue and ultimately break down the metal near the rim of the saw.

To counteract this, good circular saws are made from a special alloy steel and built up in such a way that centrifugal force will keep the cutting edge stiff and rigid while the saw is running at its correct speed. This is achieved by making the metal in the body of the saw loose, so that when the saw is idle it will wobble easily if the centre is pushed in by hand; when the saw is running, however, centrifugal force acts most strongly on the rim of the saw, which is forced outwards, thus stretching the loose metal behind until the whole saw is rigid. This looseness in the body of the saw is made by skilful hammering.

With use the requisite looseness in the body of the saw is lost and can only be replaced by hammering.

To stretch, loosen, or tension a saw a special hammer with a crowned face is used. The hammer face and saw must be clean and the blows delivered lightly about one inch apart on both sides of the saw. Haphazard hammering will result in distortion and create great internal stress manifested by buckling.

Too much hammering on the body of the saw will result in excessive looseness, which cannot be taken up by the limited expansion of the rim. The saw is similar to the bottom of an oil can, the centre of which, when pushed in, jerks through to the other side. Hammering just under the teeth will stretch the perimeter of the saw and thus make it possible for the looseness in the body to be absorbed. The amount of hammering, however, may work-harden the rim of the saw and it might crack just under the teeth.



To Illustrate Some of the Terms used in Describing Saws.

Fig 2

To ascertain whether the saw is correctly tensioned, the centre should be placed on an anvil, the edge raised slightly, and a straight edge placed along the radius. If the tension is correct, daylight between the saw and the straight edge will be clearly discernable, the maximum amount being half way along the radius. When a saw has lost its tension there is no gap between the saw and the straight edge.

In some cases a saw develops a lump or blister indicated by a blue burnt mark; this is treated by placing the saw on a flat metal surface with two sheets of brown paper between. A special cross-faced hammer is then allowed to fall on the blister with the long face of the hammer falling in the direction in which the blister runs. The blister must not be hammered--the weight of the hammer should be allowed to do the work.

This process may upset the tension of the saw so that re-tensioning may be necessary.

Saws. There are two kinds of circular saws: solid tooth and inserted tooth. The former has its teeth actually cut out of the metal during the manufacturing process and the latter has teeth which can be removed by means of a special wrench.

Solid tooth saws can be swaged or spring set.

Inserted tooth rip saws are swaged and must never be sprung set.

Setting. Saw teeth are given a certain amount of "set" so that sufficient clearance between the blade and the timber will allow its free passage through the wood. Spring setting and swage setting are the two methods employed.

Spring setting is done by bending over every second tooth a little to one side, the remaining alternate teeth are then bent over to the other side.

A gauge should always be used, as some teeth are more springy than others. When some teeth spring back after pulling over with the saw set, there is a natural tendency to overpull the teeth to counteract this, but unfortunately some teeth *do not* spring back, hence the advisability of always using a gauge. The teeth tips only should be pulled over, and not the whole tooth. The amount of set necessary depends entirely on the type and dryness of the timber being sawn. Hardwoods require less set than softwoods, and dry softwoods require, as a rule, less set than freshly felled softwoods.

It is very important that the amount of set should be the same for each tooth and the same for each side of the saw. If, by observing the cut being made, as the teeth strike the top side of the plank, a perfect vee which retains its shape as the plank

is fed into the saw, is formed, then the set is equal on both sides of the blade, but if the vee is lopsided then the set is too much to the one side, thus:—

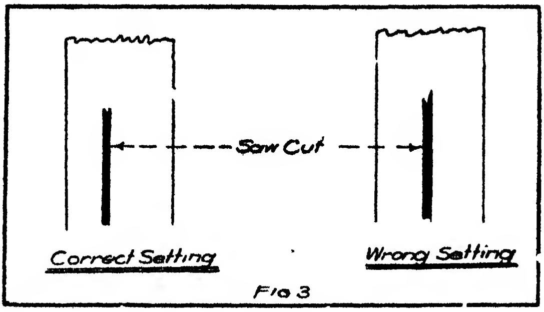


Fig 3

Swage set, and inserted rip saw teeth, have the tips spread out an equal amount on each side of the blade; this ensures a stiff upright cutting face to meet and chisel through the timber; the square cutting edge being on the same plane as the diameter of the saw, it has practically the whole body of the saw to support it. Spring set teeth, on the other hand, have the cutting edge out of this plane, so that the saw has a greater tendency to follow the grain of the wood and deflect as it meets the denser timber at knots.

Special tools, "the swager" and "side dresser" are used to swage set the teeth. The swager spreads out the metal, and the side dresser equalises the amount of spread on either side of the blade.

Inserted tooth saws have many advantages: they are swage set, they are excellent tools for breaking down round logs, they are easily sharpened, no setting is required, no gulletting has to be done, the teeth are made very hard and so require sharpening less often, the saw can be run more slowly, if a tooth breaks a new one can be installed in a few seconds, and the saws retain their tension longer than plate or solid tooth saws.

Stoning. It is absolutely essential that the saw be kept perfectly round, and that some teeth do not project beyond others. To achieve this the saw has to be stoned regularly.

Stoning is done by holding a piece of old grind stone or oil-stone squarely on the table top and letting the saw bite into it until *all* the teeth become slightly blunted; these are then filed sharp again. *Inserted tooth saws must not be stoned.*

Fitting Saws on their Spindles. When fitting a solid tooth saw on its spindle, it should be pulled firmly back against its pin before screwing up the collar. The saw will always then have the same relative position.

Inserted tooth saws are always a tight fit on the spindle and the centre hole should never be altered.

Because of the regular stoning necessary for solid tooth saws, this tightness of fit is not so necessary, especially if the saw is always pulled back against its pin.

Saw Sharpening: Spring Set Teeth. When several re-saws are running it is advisable to instal an automatic grinding machine. This embodies an abrasive revolving wheel which can be tilted at any angle and so provides the required hook, the depth of the cut is automatically controlled, and the whole operation, being mechanical, ensures that all the teeth have the same shape.

Filing. The fronts of the teeth, not the top, should be filed when sharpening, the tops should be only slightly brushed with the file to remove the brash. The tops and fronts, if given a slight bevel, will accentuate the cutting point and so sever the stringy fibres of some of the tougher timbers.

The bottoms or gullets must be kept fully rounded. Re-saws, as a rule, are not fixed to the centre of the table top but are placed to one side to allow plenty of movement of the fence, backwards. Filing one set of teeth by standing with the saw hanging in front of the fence is a simple matter, but when filing from the other side, by leaning over the wide table top, with probably a pulley also in the way, an unnatural stance has to be taken up, with the body leaning on to the file; the consequence is that more is filed off the teeth than is necessary.

The shape of the teeth should be the same all round the saw, but this factor is not so important as correct set and true roundness of the saw. The aim, however, should be to have each tooth shape the exact counterpart of its neighbour, otherwise vibration may be induced.

Sharpening inserted tooth saws. This is a much easier task. A few strokes of the file on the under side of the cutting edge and a light stroke of the file on top is all that is necessary. If, however, when sharpening, the file teeth do not grip properly but slide over the saw tooth without removing any metal and make a shrill scratching noise, it is a sure indication that the tooth is loose, the holder having lost its tension. Take out the holder, lay it on a flat metal surface, hold it firmly down with any convenient piece of wood, and strike it sharply with a fitter's hammer on its inner edge and on both sides until sufficiently expanded to hold the tooth tightly.

Inserted tooth holders must never be allowed to become rounded and should be filed straight across occasionally with a half round file. Grit on the logs, being of an abrasive nature, rounds off the edges of the holders very quickly and instead of the gullet carrying away all the sawdust some of it slips beyond the rounded edges between the saw face and the log, causing the saw to heat up.

When fitting new teeth, remove one tooth only at a time and replace it with a new one before extracting the next one.

The teeth should not be removed once they have been set in. A new set will score the timber a little, but after a few filings this will cease.

Files. Engage the file on the forward stroke and *not* on the back stroke. A file card should be used to clean the teeth. When the file teeth become dull, immerse the file in dilute sulphuric acid until the cuts are sufficiently deepened.

Saw Gauge. Text books usually recommend thin gauged saws. When, however, green timber in the round is being cut it is strongly recommended that thicker gauged saws should be used as they are less liable to deviate and a greater rate of feed is permissible.

Hook or Rake. Saw teeth require more hook angle to cut softwoods than they do to cut hardwoods. The greater the hook angle the more acute does the cutting edge become and so less power is required, but if too much hook is given, by underfiling, the teeth will lose their rigidity due to lack of backing and the saw will deviate in the cut and cause the timber being cut to splinter out.

A good method to set out hook angle for softwoods is to draw two lines at right angles to each other from the centre of the saw to the rim, bisect one line, and from the point of bisection draw another line to meet the first line on the rim, and that will give an angle at the tooth whose tangent is 0.5 irrespective of the size of the saw and that angle will be about 26½°.

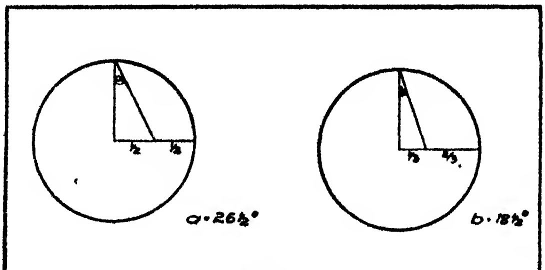


FIG. 4.

For hardwoods proceed as above, but instead of bisecting one line measure off two-thirds of the radius and from that point draw a line to meet the first line on the rim and that will give an angle of about 18½°.

Gullet. A fairly shallow gullet, a hook angle of about 26½° and a large pitch with the heel and back nicely rounded off in a gradual slope backwards has much to commend it. It makes possible a rigid blade in the cut, consumption of a minimum power, besides giving ample room to carry the sawdust through and out of the cut.

Pitch. Power, the quality of sawing desired, and the type of timber to be sawn are the factors which should govern the pitch, or distance between teeth. The power consumption is reduced as the pitch is increased, so that as the horse power is increased so should the distance between teeth be lessened. The more teeth there are on a saw the greater the braking effect. A lot of power is used up in producing a smoother finish to the

cut, each tooth having less timber to chisel through per revolution of the saw.

Conversely, the fewer the number of teeth to the saw, the greater the impact per tooth, resulting in increased vibration, and so giving a rougher finish to the cut, but the bigger gullet space permits greater ease in sawdust removal, which is vital to fast and deep cutting. Each tooth has more work to do per revolution of the saw, but the work done is positive and power is not wasted.

Saws cutting softwoods require a greater pitch than saws cutting hardwoods, and thin gauged saws require less pitch than thick gauged ones. Some American saw manufacturers recommend a pitch of 5 inches for 20 H.P. and 2¾ inches for 60 H.P.

"Lead" Break-down Saw. A break-down saw is usually run in conjunction with a travelling steel table (British design) or a log saw carriage (usually American design).

"Lead" is the slight difference in the plane in which the saw lies to that of the approach of the log on the carriage, which arrangement, when properly adjusted, ensures that the back of the saw runs just clear of the sawn wood, i.e., there is no friction. The slab splitter or riving knife prevents the off-cut from rubbing against the saw.

Sawing up a few logs and noting what happens when cutting will indicate at once whether the saw has too much or insufficient lead. If there is too much lead of the saw into the log, it will heat up near the rim, and if the lead is insufficient the saw will heat up around the collar. Moreover, if the saw shows a tendency to run into the log and cut planks thicker as it makes its exit from the cut than it did when it entered the cut it has too much lead.

It is advisable to give the saw a lead into the log of ¼ inch in 20 feet and then reduce it gradually by means of the adjustable set screws on the bearings until the saw is running free and cold.

A good way to do this is to run the carriage up until the rear-head block is opposite the centre of the saw and wedge a piece of wood about 6 inches by 3 inches by ½ inch on top of the head-block base by placing it under the knee so that the outer edge of the wood is ¼ inch from the saw. This is done easily by manipulating the set-works. Run the carriage back until the piece of wood is 20 feet from the centre of the saw, then stretch a fine line from the edge of the piece of wood along the face of the saw and adjust the spindle until the line touches both edges of the saw. The saw should then have a lead of ¼ inch in 20 feet. Run a few logs through and note where the saw heats up, if at all, and adjust as already indicated by means of the adjustable set-screws on the bearings. (Too much lead will cause the saw to heat up round the rim and insufficient lead will cause the saw to heat up round the collar.) Care should be taken to see that the line touches the saw between two successive teeth and not on the tooth points. **The packing pieces must also be moved back free of the saw blade when checking lead.**

Packing. Packing pieces or guide pins, which steady the saw, wear thin after a while and have to be replaced. Lignum vitae is recommended by saw manufacturers because of the oily nature of the wood, but the dry sapwood of gums, if boiled in olive oil for a few minutes, will serve just as well.

The thin gauged re-saws require to be packed just under the table top and on both sides of the front of the saw. The packing strips can be ordinary steam gland, or asbestos twine wrapped round a stick, and they must not be fitted in too tightly, or the heat generated by rubbing will expand the metal in the saw and upset the tension, but in certain cases it is advantageous to make use of this condition. To correct lost tension by pressing in the packing near the centre of the saw, the resulting friction will heat up that portion of the blade, cause the metal to expand and thus acquire the necessary looseness in the body of the saw. This, however, should be only a temporary expedient until the saw can be re-tensioned by hammering.

From what has already been written, it will be seen that noting where the saw has a tendency to heat up indicates at once whether the rim speed and lead are correct or otherwise, but there are other factors which will heat up the saw.

1. Bearing nearest the saw running hot.
2. Insufficient set.
3. Wood chips and compressed sawdust getting between packing and saw.
4. Saw not hanging plumb.
5. Blister on saw which rubs against the wood.
6. Saw dished.

It is unnecessary to comment on the first four points, point 5 has already been commented on; but if the saw is dished it should be retensioned and made level again, but a few points of interest in this connection are not out of place here.

If the convexity is on the log side of the saw, smear a little graphite on the fixed collar and fit a piece of paper over the spindle and against the fixed collar so that the graphite will leave a clear impression on the paper, cut all round the impression, and then cut out the central portion about half an inch from the edge, the paper will now be in the shape of a ring half an inch wide, with the outer perimeter the same as that of the outer edge of the fixed collar. Smear some grease on this paper ring in order to make it adhesive and stick it on to the face of the tight collar, then cut another paper ring, also about half an inch wide, with the central hole the same size as that of the spindle and put this smaller paper ring between the loose collar and the saw. Screw the collar up tightly and if the saw still hangs rounding on the log side, more paper rings will have to be added until the saw hangs true.

If the saw hangs concave on the log side, reverse the paper rings, but if the saw is American and runs true and cool in the log, but when standing it shows a slight concavity on the log side,

leave it severely alone, because some American saws are made a little concaved, but when the saw is running at its proper speed it becomes perfectly straight. These saws are clearly stamped on the one side "Log Side"; this is to indicate that this side of the saw is to work next to the log.

The foregoing refers more particularly to break-down saws. In the case of re-saws carrying packing from near the collar to the gullet the treatment can be different. The packing near the rim of the saw can be packed tighter so that friction will cause the saw to heat up just under the teeth; this will tend to expand the rim of the saw and pull it straight. Whilst on this subject of packing the collar, it is possible by placing two pieces of packing paper, one between the fixed collar and the saw and the other directly opposite, between the loose collar and the saw, to convert the saw to a drunken one, capable of sawing out grooves suitable for tonguing and grooving, provided the saw table can be raised to the required depth of the groove. The packing paper need only be about one inch square or less, and can be made any thickness depending on the width of the groove required. The collar need only be screwed up by hand. This method of grooving gives first class results but can only be used on small re-saw benches.

If there is no mechanical means of raising the table the bench can be built up and a suitable length of planed wood clamped down to serve as a fence.

Cross Cut Saws. Rip saw teeth chisel their way through the wood longitudinally, whereas cross cut saw teeth are designed primarily to sever the wood fibres across the grain. The teeth are usually a series of isosceles triangles, hook angle is therefore absent, and the points of the teeth are tangential to the saw circumference. Since waste from sawdust is not a very important loss when cutting across the grain, these saws are usually made of a thicker gauge, and this factor, together with the absence of tendency of the saw to follow the wood grain, obviates the use of packing unless very accurate work with thin gauged saws has to be done. Cross cut saws can be run slower than rip saws. It is not necessary to file the whole tooth: only the top half need be done.

General. The nose of the fence on the saw bench should be just on a level with the bottoms of the teeth gullets or just very slightly beyond. The nose may also be given a very slight lead into the saw if the timber shows a reluctancy to keep to the fence.

Riving knives or slab splitters should be fitted as near the back of the saw as possible in order to prevent crimping.

A push stick, notched at one end, should be used to feed the timber into the saw for the last few inches on plain re-saw benches.

The saw mandrel must be perfectly level and run tight in its bearings. In some types of roller bearings shims are provided which are removed as the bearings wear.

Annual Report of Experiments

Season 1946-47

RAINFALL.

Although the season commenced favourably with soaking rains, droughty periods of several days' duration interfered with the normal germination of the seed of nearly all crops and patchy stands resulted. The total rainfall from November 1st to April 30th was 20.86 inches, which is 14.9 inches less than the average for the previous ten years.

Analysis of Rainfall: Season 1946-47.

Month.	Number of rain days.	Total for the month.	Number of rains over ¼in.	Total for the season.	Periods exceeding one week without effective rain.
October		Nil			
November	12	4.78	4	4.78	Nov. 24—Dec. 12
December	17	4.77	5	9.55	Dec. 14—Dec. 25
January	13	4.10	7	13.65	Jan. 4—Jan. 16
February	10	2.57	4	16.22	Feb. 4—Feb. 20
March	13	3.20	4	19.42	Mar 8—Mar. 30
April	4	1.44	2	20.86	
	69	20.86	26		5 periods
Average for previous 10 years	82	35.72	42		

This tabulation shows that the number of days on which rain fell and the precipitations which exceeded one quarter of an inch were much below the average. In addition, the periods between effective rainy periods were exceptionally long. Thus, from the beginning until the end of the season the weather was unfavourable for growing crops and the yields were generally light in consequence.

The results of experiments conducted at this Station since the year 1919 have been published in Bulletin form, and, with a few exceptions, these are still available. To facilitate comparison, this report is drawn up on lines similar to previous ones.

CROP ROTATION EXPERIMENTS.

First Series, 1913-1947.

MAIZE YIELDS IN BAGS PER ACRE.

System of Cropp.ing.	1946-47 20.86	1945-46 33.25	Rainfall. 1944-45 34.59	1943-44 34.36	1942-43 45.15	1941-42 26.42	Average Yield.
*System A.—Plot A1: Maize continuous. Green manure and 250 lbs. per acre of phosphatic fertiliser in the following season—	G.M. p.u.	16 45	G.M. p.u.	9.20	11.65	G.M. p.u	12.69 (12 crops)
*System A.—Plot A2: Maize continuous. Fertiliser only, rate as above—	3.97	4 45	5.38	8.93	4.15	5.12	5.98 (19 crops)
‡System B.—Alternate Maize and Beans for hay; no manure for fertiliser	2.82	5.58	3.89	8.80	4.34	5.18	8.06 (32 years)
System C.—Three-course rotation: Maize, velvet beans (reaped), oats; no manure or fertiliser—	2.9	4.65	6.18	6.18	5.15	9.48	11.23 (32 years)
System D.—Four-course rotation: Maize (plus 6 tons dung per acre), oats, bean-hay, maize. Average of two plots	7.2	10.15	13.17	12.08	5.74	9.95	14.3
Maize (no manure direct)—	6.1	9.33	14.78	12.63	5.90	8.53	14.7 (31 years)
Maize (dunged plots)—	8.3	10.96	11.56	11.53	5.57	11.37	13 9

* Having grown maize for 15 years in succession without manure or fertiliser, during which time its yields gradually decreased until they had become negligible, this plot had served its purpose. With the object of comparing two methods of again raising the cropping power of such land to a more profitable standard, the whole plot was treated with a mixture of one-third bone and two-thirds superphosphate at the rate of 250 lbs. per acre at the beginning of 1928-29. One-half of the plot was sown to a mixture of sunn hemp and velvet beans, which were subsequently ploughed in. This manurial treatment was repeated on the respective plots during the seasons 1932-33, 1935-36, 1938-39, 1941-42 and 1944-45.

‡ In 1929-30 this system was amended from "Alternate Maize and Bare Summer Fallow" to "Alternate Maize and Beans for Hay."

Further amendments have been made to these systems of rotations during the season under review.

In **System A,** Plot A1, the land will be green manured in alternate years and the maize crop which follows will receive 300 lbs. per acre of phosphate fertiliser. In the same system, Plot A2 will receive the same amount of phosphatic fertiliser but no green manure and it will be cropped with maize continuously. Comparison of the yield of this plot (3.97 bags per acre) with those of Systems B and C (2.82 and 2.9 bags per acre) indicate that dressings of phosphatic fertiliser are at least as important as a diversified system of cropping for the maintenance of the fertility of the soil.

System B. The very low yield of less than three bags per acre is the smallest recorded for several years and is no doubt due to the combined effect of drought and lack of fertility.

System C. The yield of 2.9 bags per acre reaped in this rotation is the lowest ever recorded since these trials were commenced 33 years ago. In this system a crop of velvet beans for seed and another of oats has been grown between each crop of maize and this system of diversified cropping appears to have stabilised the maize yields so that moderately heavy yields have been obtained until quite recently. During the season under review, however, the oats were poor as well as the maize, though the yield of velvet bean seeds was larger than that recorded for several years.

System D. The maize yields in this rotation which receive the comparatively small dressing of 6 tons of kraal compost every fourth year, are seen to be more than twice as large as those of the previous rotations where no fertiliser or humus is applied.

In rotational systems B, C, anl D amendments have been introduced this season on one half of each of the original plots; here dressings of kraal compost and phosphatic fertiliser will be applied, but the original systems of cropping will be continued on the remaining half of the plots.

SECOND SERIES OF CROP ROTATIONS.

These rotations were laid down in 1919-20 and were designed to evolve a system of cropping which would meet the needs of farmers who could not adopt a system of mixed farming. The series includes two plots, A and F, on which maize has been grown continuously, excepting that, in the season 1938-39, on one half of Plot A a green manure crop was grown, the top-growth of which was composted and returned to the same plot in order to ascertain the effect of a humus dressing on land which had been continuously cropped to maize for 20 years; this treatment was repeated every third season until the year 1944-45. As it was found that the treatment of the green manure crop in the manner described did not appear to be more beneficial than ploughing it into the land without previously composting it, that method will be employed in future. Furthermore, the legume for green manure will be grown every second year instead of every

third year on the appropriate half of the plot, but on the other half maize will be grown continuously without fertiliser. On Plot F, commencing season 1929-30 (System G), phosphatic fertiliser has been applied in the same quantity and quality as that used in System H. In future the plot will be divided and on the one- half the phosphate dressing will be supplemented by the addition of 50 lbs. per acre of muriate of potash and 50 lbs. per acre of sulphate of ammonia, but the amount of phosphatic fertiliser used will continue to correspond with that used on the appropriate plots in the original and the amended Rotational System H.

System E, Plot A. Maize continuously for 28 years. Commencing season 1938-39, on one half A 1) green manure crops were grown, the top-growth of which was composted and returned again to the same plot. During the two seasons following, maize was sown, and in the seasons 1941-42, 1944-45 cropping with legumes for composting and returning to the land again was repeated. On the adjacent section (A 2) maize has been sown each year.

SEASONS AND YIELDS OF MAIZE IN BAGS (200 LBS.) PER ACRE.

	1946-47	1945-46	1944-45	1943-44	1942-43	1941-42	Average.
A 1	G.M. p.u.	9.68	G.M. Crop Composted.	7.65	9.90	G.M. Crop Composted.	9.26 (5 Crops)
A 2	3.27	2.92	5.85	5.72	1.45	3.60	4.27 (9 Crops)

Plot A 1 has been green manured during the season under review in accord with the amended plan of treatment for this plot. No other organic manure or phosphatic fertiliser will be applied to either of these plots, but agricultural lime, at the rate of one ton per acre every fourth year, will be used on plot A 2. The yield recorded on Plot A 2 this season is a third of a bag per acre more than last year. As the yield of all the other plots in these rotation trials which do not receive organic manure and/or phosphatic fertiliser is less than that of last season it may be assumed that this increase is due to the dressing of lime given at the beginning of this season.

System F, Plots B to E. Three-quarters of the land under maize, one-quarter under Sudan grass. Each year one section under maize, commencing with Plot B in 1919-20, received eight tons of farmyard manure per acre, and commencing on Plot F, in 1929-30, the section which grew Sudan grass the previous season, receives 200 lbs. per acre of phosphatic fertiliser.

	1946-47	1945-46	1944-45	1943-44	1942-43	1919-20	Average 1920-47
Plot B	3.92*	Sudan	9.40	12.70‡	7.78*	26.0	14.49
Plot C	Sudan	9.10	14.23‡	9.28*	Sudan	23.7	13.99
Plot D	7.80	8.82‡	7.45*	Sudan	6.45	Sudan	12.96
Plot E	8.03‡	5.22*	Sudan	12.80	7.30‡	24.6	13.59
Average	6.57	7.71	10.37	11.59	7.84	24.7	13.76

* Indicates the application of farmyard manure.
‡ Indicates the application of 200 lbs. per acre of phosphatic fertiliser.

These rotations show the beneficial effect of the application of kraal compost. The land which received the dressing this season yielded twice as much as the land to which fertiliser was applied.

During the season 1940-41 an amendment was introduced into this rotation by replacing the Sudan grass and the intermediate maize crop with soya beans. Hence, in the new scheme, soya beans and maize alternate with each other. The kraal compost is applied to one of the soya bean crops, but the phosphatic fertiliser application is followed by maize.

In the tabulation below, the yields obtained on the amended rotation are shown adjacent to those in the original system.

MAIZE AND SOYA BEAN YIELDS IN BAGS OF 200 LBS. PER ACRE.

	1946-47		1945-46		1944-45	
	New System.	Old System.	New System.	Old System.	New System.	Old System.
Plot B	M 9.25*	3.92*	B 4.43	Sudan	M15.53	M 9.40
Plot C .	B 3.00	Sudan	M14.92	9.10	B 8.20‡	M14.25‡
Plot D . . .	M10.00	7.80	B 5.82‡	8.82‡	M14.45*	M 7.45*
Plot E .	B 5.70	8.03‡	M11.90*	5.22*	B 5.90	Sudan
Average Maize Yield	9.63	6.57	13.42	7.71	14.99	10.33
Average Bean Yield	4.35		5.13		7.05	

M, Maize; B, Soya Beans; Sudan, Sudan Grass.
* Indicates the application of 200 lbs. per acre of phosphatic fertiliser.
‡ Indicates the application of farmyard manure.

The total maize yield of the two plots in the amended system is 19.25 bags and this is only half a bag less than that of the three plots in the old rotation. In the amended rotation there was a crop of soya beans of considerable value in addition to the maize crop. This system of cropping seems to be a very satisfactory one, for it provides material which can either be marketed as soon as it is harvested, or it may be used as stock feed on the farm. The manurial dressings have maintained the productive capacity of the soil at a fairly high level, but the yields have diminished somewhat, which suggests that it may be found necessary to increase the amount of manure applied if it is desired to increase the yields.

System G, Plot F. Maize continuously. No manure or fertiliser during the first 10 years. Commencing season 1920-30, fertiliser similar in kind and in quantity to that provided in System H has been applied to this plot.

SEASONS AND YIELD OF MAIZE IN BAGS PER ACRE.

1946-47	1945-46	1944-45	1943-44	1942-43	1919-20	Average over 28 years.
3.70	3.8*	4.80	9.45*	4.68	23.3	9.4

* Indicates the application of 200 lbs. per acre fertiliser.

In common with the other plots in this series, this plot was divided into two during the season under review, and one half received a dressing of one ton per acre of agricultural lime. The yield on the limed part was 4.0 bags per acre. The increase of 0.3 bag is the same as that obtained in System E and it may be due to the application of lime. Commencing season 1947-48 this plot will receive a dressing of 400 lbs. per acre of "complete" fertiliser in alternate years. This will supply potash and nitrogen and we shall be able to compare the effect of these chemical fertilisers with that of the green manure crops in System H, where the land will receive the same amount of phosphatic fertiliser as in this amended system.

System H, Plots G to K. Three-quarters of the land under maize, one-quarter under velvet beans, which are ploughed under for green manure. From the commencement of this experiment until 1928-29 this land received one green manuring and one application of fertiliser during each period of four years. The returns from these plots showed that insufficient plant food had been supplied to maintain fertility, and the manurial system was then amended to provide for two dressings of fertiliser during each four-year period. The crop of maize which follows the green manuring now receives 200 lbs. fertiliser per acre, which should enable it to make the best use of the nitrogen supplied by the green manure; the second maize crop receives no fertiliser, and the third crop—that immediately in front of the bean crop—receives 200 lbs. per acre of phosphatic fertiliser.

SEASONS AND MAIZE YIELDS IN BAGS PER ACRE.

	1946-47	1945-46	1944-45	1943-44	1942-43	1919-20	Average 1920-47
Plot G	11.10*	Beans	6.50*	11.05	12.33*	23.10*	13.25
Plot H ..	Beans	5.10*	6.70	18.55*	Beans	23.00	13.88
Plot J .	7.30*	6.92	19.70*	Beans	4.75*	Beans	12.50
Plot K	4.30	16.35*	Beans	12.08*	6.70	19 20	12.96
Average .	7.57	9.46	10.97	13.89	7.93	21.70	13.15

* Denotes the application of fertiliser.

This season's results support those of previous years in that the yield of the plot of maize which followed the ploughing under of velvet beans for green manure is equal to the combined yield of the other two plots in the rotation.

The plots in this rotation have been divided and the system of cropping on one half has been changed to one in which each maize crop is preceded by velvet beans ploughed under for green manure. Each maize crop will receive 300 lbs. per acre of phosphatic fertiliser and a dressing of one ton of lime per acre will be given every fourth year.

During the season under review the yield of maize on the amended section was 11.43 on plot G and 7.38 on plot J, hence it is seen that the increase due to the extra fertiliser and lime was very small.

THIRD SERIES OF CROP ROTATIONS.

In the season 1926-27 two more rotational systems were laid down, which have been designated Systems M and O respectively.

System M. This is a four-course rotation in which the sequence of the crops is:—Maize plus 200 lbs. per acre of phosphate; groundnuts; maize plus 200 lbs. per acre of phosphate; green manure. Hence one-half of the land is sown to maize each year, one-quarter to groundnuts, and the remainder is green manured.

In the following tabulation the yields of the crops are given in bags per acre, a "bag" of maize being 200 lbs. and a "bag" of groundnuts 65 lbs.

YIELDS OF MAIZE AND GROUNDNUTS IN BAGS PER ACRE.

	1946-47	1945-46	1944-45	1943-44	1942-43	1926-27	Average 1926-47
Plot A	G.M.	8.30*	23.00N	17.67*	G.M.	G.M.	13.00
Plot B	9.58*	9.70N	16.91*	G.M.	7.67*	15.15	11.11
Plot C	20.2N	13.94*	G.M.	15.20*	6.80N	21.00N	13.38
Plot D	8.90*	G.M.	14.04*	11.00N	10.23*	12.06	11 49
Average	9.24	10.65	15.48	16.44	8.95	13.88	12.37

* Denotes the application of fertiliser.

G.M. Denotes the application of green manure.

N Denotes the position of the groundnuts in the rotation.

The maize yields in this rotation are slightly lower than those of last year, but they are comparable with those obtained this year in System F, where maize alternates with soya beans. The groundnuts yielded well, indicating that this crop is resistant to droughty conditions. The advantage of having more than one kind of crop in the rotation is shown in this system this year, for although the maize yields have been reduced by drought, the groundnuts yielded better than usual and have largely offset the deficiency in the yield of maize.

Although this system of cropping and fertilising the land has served to maintain its productivity at approximately the same level as it was twenty years ago, the amount of fertiliser applied has not increased the yielding ability of this soil. With a view to raising the fertility level, the plots have been divided and on one series of sub-divisions a dressing of 8 tons of kraal compost will be applied to the groundnut crop and a dressing of 2 tons per acre of agricultural lime will be applied every fourth year.

System N, Plot E. Maize continuously. Phosphatic fertiliser of the same kind and quantity as in System M has been applied to this plot.

1946-47	1945-46	1944-45	1943-44	1942-43	1926-27	Average (21 years).
3.13	2.15	5.83	7.24	1.95	14.70	6.62

The yields on this plot corroborate those of other systems where no humus forming material is supplied. They show that when phosphate is applied and the rainfall is favourable, fairly good yields are obtained, but when climate conditions are unfavourable, the yields become so low as to be sub-economic.

This plot has been divided and on one-half in addition to 200 lbs. of phosphate, applications of 50 lbs. muriate of potash and 50 lbs. sulphate of ammonia per acre will be made on alternate years.

System O. The order of rotation is:—Maize, fertilised with 220 lbs. per acre of raw rock phosphate; sweet potatoes; maize, which receives a dressing of 8tons per acre of kraal compost; legume hay. This system is suitable for farmers who prefer to feed a large proportion of their crops to livestock.

In the tabulation below are shown the acre yields of maize in bags of 200 lbs. and of bean hay and sweet potatoes in tons. Edible canna replaced sweet potatoes in the seasons 1944-45-46-47.

SEASONS AND YIELDS IN BAGS (OR TONS) PER ACRE.

	1946-47	1945-46	1944-45	1943-44	1942-43	1926-27	Average 1926-47
Plot F ..	H1.8	8.7*	P1.1	16.33‡	H2.00	H1.10	15.33
Plot G . ..	15.68*	P2.2	14.8‡	H2.4	10.05*	19.65*	14.08
Plot H	P0.84	9.3‡	H2.2	10.41*	P2.38	P6.10	14.79
Plot J	10.95‡	H2.3	12.2*	P2.43	6.95‡	16.45‡	11.65
Average maize	13.32	9.0	13.45	13.37	8.50	18.05	13.96

‡ Denotes the application of fertiliser.

* Denotes the application of kraal compost.

P Denotes the position of the sweet potatoes in the rotation.

H Denotes the position of the hay crop.

The beneficial effect of the dressing of kraal compost is most marked this season. The yield of the plot which received fertiliser only, is seen to be better than that of the plot which was similarly treated last year. These results conflict with those obtained in the other rotations where the yields are lower than those of last season, but the reason for this is not apparent.

In this rotation, additional nutrient material is being given on one half of the series of plots. In the amended rotation, both crops of maize will receive 8 tons of kraal compost and 300 lbs. of phosphate per acre and the land will receive a dressing of 2 tons of lime every fourth year.

The original systems were designed to acquire information with a view to finding the most economical means of producing maize and other crops and their effect on the cropping power of the land. They have shown that the minimum requirements for maintaining the cropping ability of this land at a moderate fertility level are 100 lbs. to 125 lbs. per acre per annum of superphosphate (19 per cent. P_2O_5), or its equivalent in some other kind of phosphate, and humus forming material such as kraal compost, at the rate of 8 tons per acre, or alternatively green manure, at least every third or fourth year. Rotational systems

in which leguminous crops alternate with maize are likely to prove more profitable than those in which maize occurs more frequently.

In the amended systems a mixture of equal proportions of raw rock phosphate and superphosphate will be applied at the rate of 150 lbs. per acre per annum and compost or green manure will be applied at more frequent intervals than in the original systems. This treatment will raise the fertility level of the land and should result in a considerable increase in the weight of the crops.

It is anticipated that the results of these amended systems will provide a valuable guide to the most economical methods for increasing the Colony's capacity for food production to meet the needs of a larger population.

SUBSTITUTES FOR SUNN HEMP FOR USE AS GREEN MANURE

Having received several requests from farmers for a crop to use for green manure in the place of sunn hemp, which is so often destroyed by attacks of Exora beetles, other crops which might be used instead were sown in trial plots in the season 1945-46. These were—velvet beans; Sesbania sp., Munga and Rhodesian Sudan grass, used in the manner recommended for ridding the land of witch-weed. Sunn hemp was also included, but the precaution was taken to delay sowing it until December 27th, 1945. It was found that by sowing it late in the season it escaped attack from beetles and a very good crop was available for ploughing under. Maize was sown over the whole area during the season under review. The average yields of grain in bags per acre from each series of ten replicated plots was as follows:—

Sunn hemp, 14.54; Velvet beans, 14.33; Sesbania, 12.31; Sudan grass, 11.59; Munga, 11.45.

These figures show that with the exception of velvet beans the other crops are not as effective when used for green manure as a late-sown crop of sunn hemp.

. EFFECT OF DIFFERENT INTERVALS BETWEEN APPLICATIONS OF GREEN MANURE.

In the season 1939-40, experiments were commenced for the purpose of comparing the effect of green manuring at various intervals on the yields of maize crops grown during the intervening years, the object being to enable farmers to decide as to whether the practice of green manuring at frequent intervals is likely to be more profitable than the growing of more crops of maize between green manurings or vice versa. Included in this series of trials are plots on which leguminous crops are grown at various intervals and used as hay or as silage, while on others the legume crop is allowed to mature and the seed is reaped. These trials include plots on which manuring is replaced by a four-year grass ley, and others in which a three-year grass ley is supplemented by one green manure crop during each eight-year period.

The following tabulation shows the method of cropping practised in each rotational system over a period of eight years.

Each system is employed on eight to ten plots, and the cropping within each group of plots under the same rotation is staggered through the years in order that seasonal climatic effects may be eliminated as far as possible from the final results. For example, System D involves the use of nine plots; each season three of these are green manured, while the remaining six are cropped with maize.

In the tabulation M equals Maize; GM equals Green Manure; LH equals Legume Hay (silage); LS equals Legume for Seed; G equals Grass Ley.

LEGUME—MAIZE ROTATIONAL SYSTEMS.

System Symbol.	1st Year.	2nd Year.	3rd Year.	4th Year.	5th Year.	6th Year.	7th Year	8th Year.
A	GM	M	GM	M	GM	M	GM	M
B	LH	M	LH	M	LH	M	LH	M
C	LS	M	LS	M	LH	M	LS	M
D	GM	M	M	GM	M	M	GM	M
E	LH	M	M	LH	M	M	LH	M
F	LS	M	M	LS	M	M	LS	M
G	GM	M	M	M	GM	M	M	M
H	LH	M	M	M	LH	M	M	M
J	LS	M	M	M	LS	M	M	M
K	GM	M	M	M	M	GM	M	M
L	LS	M	M	M	M	LS	M	M
M	M	M	G	G	G	G	M	M
N	M	G	G	G	M	M	GM	M
O	M	M	M	M	M	M	M	M

The lay out of the experiment provides a single plot for each method of cropping on each block of land. Eight complete blocks of land are used, but additional plots were found necessary in order that the complete cycle of rotation may be practised each year in the case of Methods D, E, F, K and L, and thus avoid a possible bias due to seasonal climatic effects.

Phosphatic fertiliser is applied at the rate of 150 lbs. per acre per annum in all systems excepting those which include grass leys. The fertiliser is composed of equal parts of raw rock phosphate and superphosphate.

In the following tabulation the average yield of maize obtained in each system during the five-year period 1942-47 is shown. The figures given are the yields per acre of the whole area under each system of cropping. Hence in System A, where green manure and maize are grown in alternate years, only one-half of the land is sown to maize each season. The yield given in the tabulation below represents the total yield divided among all the plots in the rotation so that the yield given for System A is only one-half of that obtained from the plots which actually carried the maize crop. The systems which include grass leys are not included, as that method of treatment has not been practised long enough to provide reliable information as to its effect on the maize yield.

However, it has been clearly shown that when the time comes for breaking the grass sod it is advisable to plough the land early in the season to promote early and complete decomposition of the grass roots. When the breaking of the sod is delayed and the maize is sown among undecayed roots, the crop is likely to suffer from nitrogen starvation and give a low yield of grain in consequence. The results obtained so far indicate that it may be found more profitable to follow the breaking of the sod with a leguminous crop than to sow maize as the first crop after grass.

EFFECT OF THE LEGUME CROP ON THE MAIZE CROP(S) WHICH FOLLOW.

System Symbol.	No. of Maize Crops between each legume crop.	Use of Legume.	Seasons and Maize Yields in Bags per Acre over the whole Area, including land under Green Manure. 1942-43	1943-44	1944-45	1945-46	1946-47	Total.
A	1	G.Manure	7.8	10.0	8.7	7.1	5.3	40
B	1	Hay	2.7	8.1	3.8	4.1	3.6	22
C	1	Seed	4.1	6.6	4.4	3.7	1.7	21
D	2	G.Manure	6.0	9.8	9.1	7.0	4.9	37
E	2	Hay	5.2	7.4	5.1	4.7	5.0	27
F	2	Seed	4.4	7.8	5.9	3.6	3.0	25
G	3	G.Manure	7.1	11.1	8.4	5.8	5.4	38
H	3	Hay	3.7	8.4	5.2	3.1	5.7	26
J	3	Seed	4.7	8.9	5.4	3.1	4.0	26
K	4	G.Manure	5.0	10.4	7.6	5.3	4.9	33
L	4	Seed	5.2	10.0	5.9	3.5	4.0	29
O	Maize continuously	—	4.4	11.9	6.9	3.2	6.4	32

The returns from these plots during the season under review show that the effect of the various manurial treatments may differ widely during a season of light rainfall from those obtained in a normal season. The maize yield following the legume seed crop, was markedly poor, due no doubt to the fact that the ploughing under of the un-rotted residue of the legume had a harmful effect on the condition of the soil. Under field conditions this depressing effect could be prevented by removing the residue of dry stalks by grazing with livestock or by collecting it for conversion into compost. These returns show that the yields in the systems where the legume is used as hay have increased considerably during recent years. This is because it has been assumed that under farm conditions the legume hay would be fed to livestock and kraal compost would be available for application to the cultivated land. Hence those systems in which the legume is removed for hay (or silage) are now receiving a moderate dressing of kraal compost.

In the tabulation, the yield recorded where maize is grown continuously is given as 6.4, as against 5.3 for the system in which the land is green manured in alternate years. When comparing these figures, it must be remembered that the yield in the green manure-maize rotation was 10.6 bags per acre, for those plots on which maize was actually grown. When it is remembered that in this system only one half of the area is sown to maize and in that way costs of cultivation are considerably less than they would be over double the area where maize is grown continuously, it is probable that under field conditions the difference would not be as great and the extra cost of cultivation would offset the 1.1 bag per acre extra yield recorded this year in favour of the maize continuous plots. Furthermore, the yield for the five-year period 1942-47 is 25 per cent. in favour of the system in which maize alternates with green manure.

When comparing the yields given in the last column of the tabulation, it should be remembered that considerable revenue would accrue from the hay or the seed where the legume is used for those purposes. Hence, under certain conditions, it might be found more profitable to use the legume in either of these ways instead of green manure, but the cropping power of the land would be likely to decrease unless steps were taken to maintain the humus content of the soil with applications of compost.

GROUNDNUT VARIETY AND SOYA BEAN STRAIN TRIALS.

Both of these crops have proved very suitable for growing in rotation with maize, and as they supply the important nutrients oil and protein, they are always in demand by livestock feeders and manufacturers. As their uses are similar, they may be considered as rival crops and the purpose of these trials is to compare their yields in order that the farmer may be guided in his choice between them. Although both are rich in protein and oil, they supply these in different proportions. Groundnuts contain less protein than soya beans, but they are much richer in oil. All of the operations connected with the cultivation of soya beans can be carried out by machines which are commonly used for other

crops, but groundnuts have to be harvested by hand labour, except where they are grown on a large scale, in which case the investment in expensive special machinery may be justified. Hence the cost of growing groundnuts is considerably higher than that of growing soya beans on a similar area.

The following tabulation shows the result of trials in which three varieties of groundnuts were planted in much replicated plots and interspersed among strain trials of soya beans. The droughty periods experienced during the season under review adversely affected the yield of the soya beans more than those of the groundnuts. The protein and oil yields are calculated from the amounts found by the Chief Chemist, who kindly made special analyses of samples of seed grown in these trials.

YIELDS IN LBS. OF SEED, OIL AND PROTEIN PER ACRE.

Groundnuts.	Seed.	Oil.	Protein.
Valencia .	. 1,011 (kernels)	(50.5%)	(30.6%)
		511	309
Soya Beans.			
Herpotch No. 297 strain	1,130	(18.6%)	(40.5%)
		210	458
Hernon No. 107 strain	769	(14.6%)	(40.5%)
		112	311

The estimations of oil and protein shown in the tabulation above are based on the heaviest yielding variety of groundnuts and the heaviest yielding strain of soya bean which has emerged in our trials. Hitherto, Hernon No. 107 has been considered our heaviest bearing soya bean and at the present time it is the most widely grown variety in this Colony. These trials show that the yield of groundnut kernels is about equal to that of seed of our best strains of soya bean, but owing to its much higher oil content the groundnuts yield two or three times as much oil per acre as soya beans. On the other hand, soya beans contain the most protein, which makes this crop the more valuable of the two for feeding to livestock on the farm, where the requirements of oil and carbohydrates for stock feed could be more economically produced by the cereal crops.

Groundnut Variety Trials. Although very good stands were obtained as a result of favourable climatic conditions at the time of sowing, the droughty periods which followed affected the yields adversely. Comparison of the last two columns in the tabulation given below shows that this season's yields were less than the average for the past eight years. Nevertheless, in comparison with nearly all other farm crops suitable for this Colony, this crop is, at least, as capable of resisting the effects of droughty periods as well as any of the food crops.

YIELD OF NUTS-IN-SHELL IN BAGS (OF 65 LBS.) PER ACRE.

	1941-42	1942-43	1943-44	1944-45	1945-46	1946-47	Average of 8 Seasons.
Virginia Bunch	20.8	15.7	28.8	32.2	53.4	19.5	28.3
*Valencia	21.2	9.8	30.1	24.0	42.7	21.5	23.5
Indian Coromandel	15.5	14.7	31.8	30.3	45.2	20.9	25.5

* This variety is locally known as "Spanish Bunch."

The variety known as Valencia, or Spanish Bunch, was not as much affected by the drought as the others. This is probably because it matures more quickly than the others. Similar results were recorded in the season 1941-42, when the rainfall during February was 3.13 ins. and the total for the season 26.42 ins. It appears therefore that the Valencia variety is more resistant to the effects of drought than the others and that it would be the most suitable variety for the low rainfall areas of the Colony.

Soya Bean Strain Trials. A new series of strains was established by crosssing some of the more promising Hernon strains with one which originated at the Potchefstroom Research Station known as strain No. 184. The object was to obtain strains which would have the tall, robust habit of the Hernon strains combined with the desirable characteristics of the Potchefstroom variety, such as the "non-shattering" of the seed, drought resistance, heavy yield of seed, etc. The composite name of Herpotch has been given these strains. Some two to three hundred strains were established from promising single plants. The elimination of strains exhibiting weaknesses brought the group down to less than a score for sowing after the 1945-46 season's trials. Further trials during the season under review have indicated that No. 279 is the most consistent seed producer. Two or three other kinds are nearly as good and either of these might prove to be better than No. 279 in other districts, where the climatic conditions are different from those of this Experiment Station. In our strain trials these have yielded 20% to 30% more seed than Hernon No. 107. Small quantities of seed of these new strains of soya beans will be available for issue to farmers after the 1947-48 harvest.

VELVET BEAN HYBRIDS.

About ten years ago two strains of velvet beans, namely Marbilee and Jubilack, were issued to farmers, and they have proved to be particularly suitable for use as hay, because of their heavy growth of vines and late maturity. It was known at the time they were issued that the strains were not genetically pure,

but as their growth would be used for hay that was not of major importance under the prevailing circumstances. The strain called Jubilack had a rather serious defect in that although it invariably produced a large quantity of vine growth, its yield of seed was sometimes very small. Later a number of single plant selections were made within this variety. After much testing in replicated plots, the strain No. 74 was found to be the best and seed of it has been sent to the Gwebi Government Farm for propagation and issue to farmers. In addition to this work, the Jubilack strain has been cross-bred with another variety which consistently produces a large amount of seed. Several very promising strains have been obtained. During the past two seasons the best of these (viz., strain No. 52) has produced 50 per cent. more stalk and leaf growth than the Somerset variety and nearly as much seed. One of these strains (viz., No. 77) produced 100 per cent. more stalk and leaf growth than the Somerset variety, but its seed production was only 65 per cent. of the standard variety. The smaller production of seed is due to its very late maturity, which under local conditions does not permit the whole of the seed crop to attain complete development. It is possible that in those districts which enjoy a longer frost-free season than Salisbury this strain might prove to be the most profitable one to cultivate.

In response to the resolution which was passed by the Congress of the National Farmers' Union, these heavy yielding late maturing strains of velvet beans will be known as the "Arnold Velvet Beans" in acknowledgment of the work done by the writer.

For the information of farmers who have not previously grown these strains, it may be added that if it is desired to reap a crop of well-developed seed, the crop should be sown as early in the season as possible. Usually it is found convenient to sow early in November before rain has fallen. When it is proposed to use the crop as hay, sowing should be delayed until the latter part of December, in order that the seed pods will not have become large enough to interfere with the curing of the hay when the vines are cut in the months of April or May following. Early sowing is recommended when the growth is to be used as silage.

Small quantities of seed of these strains will be supplied to farmers upon application to the Chief Agriculturist, Department of Agriculture.

H. C. ARNOLD,
Manager, Agricultural Experiment Station.

Rhodesian Milk Records

OFFICIAL MILK RECORDS.

Name of Cow.	*Breed*	*Age.*	*Milk in lbs*	*B. Fat in lbs.*	*Average % B. Fat*	*No. of Days.*	*Name and Address of Owner.*
Matopo Select	Red Poll	Mature	6963.30	260 23	3.74	300	Government Experiment Station, P.B. 19K, Bulawayo.
Matopo Unice	Red Poll	Sen. 3 years	6592.20	263 64	3 98	300	
Matopo Victoria	Red Poll	Jun. 3 years	8164 90	305.29	3 74	300	
Matopo Violet	Red Poll	Jun. 3 years	8020 90	301.19	3.76	300	
Matopo Quereen	Red Poll	Mature	8156.00	316 66	3.88	300	
Matopo Rose	Red Poll	Mature	6476.50	214.35	3.31	283	
Matopo Usherette	Red Poll	Jun 4 years	4910 80	178.42	3.63	259	
Mignonette's Blossom of Wanganella	Guernsey	Mature	8024.50	421 90	5.26	300	E. J. Hards, Churchill Farm, Marandellas.
Mitchlin Dainty E (Recalved 10.5.48)	Friesland	2 years	7331 00	267.22	3.65	300	W. S. Mitchell, Springs Farm, Iron Mine Hill.
Mitchlin Dainty A II. (Recalved 14.4 48)	Friesland	Jun 3 years	9410.50	313.51	3.33	300	
Mitchlin Dainty D (Recalved 13.5.48)	Friesland	Sen 3 years	10525 50	350 40	3 33	300	
Mitchlin Dorina D (Recalved 4.5.48)	Friesland	Jun. 4 years	7270 50	255.33	3.51	300	
Mitchlin Dignity D I. (Recalved 13 5.48)	Friesland	Sen. 4 years	10766 00	347.51	3.23	300	
Mitchlin Dignity C II. (Recalved 29.3.48)	Friesland	Mature	12296.00	382.76	3 11	300	
Mitchlin Winona (Recalved 21.4.48)	Friesland	Mature	10198 00	387.08	3.80	300	
Sheep Run Lily (Recalved 22.5.48)	Friesland	Mature	9697.00	293 40	3 03	300	

SEMI-OFFICIAL MILK RECORDS

Betty	G. Friesland	Mature	7831.50	284 84	3 64	300	D. A. Allan, Pendennis, P.O. Avondale.
Jackson	G. Friesland	Mature	7649.00	271 18	3.55	281	G R. Anderson, Warrender Farm, Box 8, Gwelo.
No. 53	G. Friesland	Mature	6314 00	243 44	3 86	300	
Albert Vale Lena XVII	P B. Friesland	3 years	8228.80	268 07	3.26	300	J. A. Baxter, Glen Norah, Box 1368, Salisbury.
Chemite C. 30	G Friesland	Mature	8703.80	308.40	3 54	300	
Chia	G. Friesland	Mature	8299 60	309 99	3 75	300	
Dick	G. Friesland	Mature	10042 10	375 57	3 74	300	
Ireland	G. Friesland	3 years	5898 30	246 56	4 18	300	
Lords	G Friesland	Mature	6976.20	268.11	3.84	300	
Norton D. 45	G. Friesland	Mature	8234 30	297 26	3 61	300	
D. 69	G. Friesland	Mature	8284 70	292.37	3.54	275	A L Bickle, Box 595, Bulawayo
D. 119	G Friesland	4 years	7259 20	243.33	3.35	300	
D. 134	G. Friesland	4 years	6620 40	268 19	4 05	246	
Nyama	G. Friesland	3 years	6641 00	284 24	4 28	300	Miss N. Brereton, Coolmoreen, Gwelo.
Agnes	G. Friesland	Mature	6498 00	227.75	3 50	251	M. W. Burras, Hertford Farm, Box 443, Bulawayo.
Hayfield	G. Friesland	Mature	6052 00	244 86	4.05	300	
Leslie	G. Friesland	Mature	10108 00	385 05	3 81	300	
Marie	G. Friesland	Mature	11543.50	374 18	3 24	300	
Bess	G. Friesland	Mature	9669.00	350.80	3.63	300	E Butler, Woodlands, P O. Shamva.
Mary	G Friesland	Mature	7466 00	264.52	3 54	300	
Sophie	G Friesland	3 years	7205 00	333 54	4.63	300	
Wilful Fat	G Friesland	4 years	7560 00	272 02	3.60	300	
Betina	G. Guernsey	Mature	7956 10	287 15	3 61	300	D L. Cameron, Lochiel, Fort Victoria.
Elf I.	G Friesland	Mature	7009.00	231 68	3 31	300	
Sally	G. Friesland	4 years	7785.60	251 37	3 23	300	Est. late R. Jackson Clark, Kingston Farm, Gwelo
Seven	G Friesland	Mature	7380 90	239 63	3 25	279	
Storm	G. Friesland	Mature	7022.80	243 95	3 47	300	
Marie	G. Friesland	4 years	6901 00	253.51	3 67	300	A C. De Olano, Blue Waters, P.O. Bromley.
Praha	G Friesland	Mature	8928 00	346.79	3 88	300	
No. 14	G. Friesland	2 years	6815.30	257 81	3 78	300	J B. Dold, Box 1153, Salisbury.
No. 273	G. Friesland	3 years	6339 40	228 29	3 60	300	
No. A. 146	G. Friesland	Mature	7758 70	261.79	3.38	270	
No. R. 165	G. Friesland	Mature	7346.90	240.14	3 27	300	

SEMI-OFFICIAL—(Continued).

Name of Cow.	*Breed.*	*Age.*	*Milk in lbs.*	*B. Fat in lbs.*	*Average % B. Fat.*	*No. of Days.*	*Name and Address of Owner.*
Crest	G. Friesland	Mature	6166.10	240.34	3.89	296	B. St. J. D. Downs, Safago Farm, P.B. Gwelo.
No. 333	G. Guernsey	Mature	7528.80	271.11	3.60	300	
No. 337	G. Guernsey	Mature	8693.90	344 30	3.96	300	
No. 368	G. Guernsey	Mature	8482.50	375.03	4.42	300	
No. 457	G. Guernsey	4 years	6402.20	252.38	3 94	300	
No. 469	G. Guernsey	3 years	6349 80	300.75	4 74	286	
No. 473	G. Guernsey	2 years	7123.10	263.13	3.71	300	
Suzanne II.	G. Friesland	Mature	6176.00	228.90	3.71	246	Mrs. M. Everard, Castle Zonga, Inyazura.
No. 153	G. Friesland	Mature	9269 00	357.86	3.86	284	
No. 244	G. Friesland	Mature	6708 00	248.56	3.71	230	
No. 213	G. Friesland	Mature	9324 00	280 30	3 04	284	H. C. Fischer, Olivia Farm, Headlands.
No. 223	G. Friesland	Mature	6861.50	257.40	3.75	245	
No. 225 C.	G. Friesland	Mature	7273.50	257 66	3.54	262	
No. 33	G. Friesland	Mature	10729.00	389.17	3 63	300	R Le S. Fischer, Wakefield, P.O. Headlands.
No. 44	G. Friesland	Mature	11415.00	421 51	3.69	300	
No. 76	G. Friesland	Mature	7802.00	312.71	4.00	240	
No. 107	G. Friesland	4 years	9465 00	333 39	3 52	273	
No. 414	G. Friesland	Mature	6496 00	271 92	4 19	261	W. F. Fischer, Coldstream Dairy, Headlands.
No. 553	G Friesland	3 years	6176.00	234.59	3.80	300	
No. 426	G. Friesland	Mature	8189 00	304 36	3.72	300	
No. 482	G. Friesland	Mature	5649 00	242 74	4 30	236	
Cigarette	G. Friesland	2 years	9226.10	335.73	3 64	300	G J. Franklin & Son. Box 105. Umtali.
Dun	G. Friesland	Mature	9041 80	398 22	4.40	289	
Fern	G. Friesland	3 years	7850.10	370 26	4.71	300	
Ganganda III.	G. Friesland	Mature	6938.40	332.95	4.78	279	
June	G. Friesland	Mature	6924.00	285 08	4.12	257	
March	G. Guernsey	2 years	5703.60	231 39	4 06	300	
May	G. Red Poll	2 years	7070.00	304.56	4 31	290	
Miranda	G. Friesland	2 years	8717 30	360.66	4.14	300	
M'Plate II.	G. Friesland	Mature	6283.00	246.23	3 92	244	
Naomi	G. Friesland	2 years	6040 90	260 53	4 31	300	
Peggy	G. Friesland	Mature	9983 40	382.25	3.83	300	
Pipe	G. Friesland	2 years	6668.90	258.46	3 88	300	
Spotty	G. Friesland	2 years	8997 50	359 42	4 00	300	

Madeline	G. Friesland	3 years	7768 90	317 18	4 08	300	
Mgurwe II.	G. L R 'Shorthorn	Mature	6834 60	314 99	4 61	259	
Mina	G. Friesland	Mature	9214 80	384.16	4 17	300	
Penny	G. Friesland	3 years	9209 50	333 58	3.62	300	
Whinburn Sleepy	P.B Friesland	Mature	9363 40	354 10	3 78	300	
No. 14	G. Friesland	4 years	7468 40	303 07	4 06	300	P Freeland, Lingfield, Gwelo.
No. 19	G. Friesland	4 years	9574 00	336 55	3 52	300	
No. 29	G. Friesland	4 years	7106 70	264 84	3 73	300	
No. 183	G. Friesland	4 years	7608 50	264 23	3 47	290	
No. 193	G. Friesland	Mature	7454 30	247 98	3 33	300	
No. 197	G. Friesland	Mature	7406 00	248 05	3 35	300	
No. 440	G Guernsey	4 years	8553 00	319 41	3 73	300	
Gondall	G. Friesland	Mature	8313 90	269.79	3 25	300	
Jermima	G Friesland	Mature	9639 42	326 55	3 39	300	
Major	G. Friesland	Mature	7412.90	231 00	3 12	300	
Susannah	G Friesland	Mature	9205 10	277 05	3 01	300	
Toto (No. 146)	G. Friesland	Mature	8182 20	267 92	3 27	300	
Straybelle	G Friesland	Mature	7062 90	267 05	3 78	300	G. G. Futter Marjoribanks, P O Gwelo
Flossy	G. Red Poll	Mature	5858.00	246 57	4.21	300	
No. 120	G Friesland	Mature	5631 80	227 46	4 04	267	W N Gebbie, P.B. 19A. Salisbury.
No. 129	G. Friesland	Mature	6862.20	279 28	4.07	300	
No. 154	G. Friesland	Mature	6304 30	268 81	4.26	300	
No. 162	G Friesland	4 years	6210 60	245.46	3.95	249	
Fanny	G Friesland	Mature	9610.00	324 18	3 37	300	Hon H V Gibbs, Bonisa, Redbank, Bulawayo.
Gay	G. Friesland	Mature	8280 00	263 24	3 18	300	
Honey	G Friesland	Mature	7045 00	283 90	4 06	300	
Linda	G Friesland	Mature	9066 00	318.58	3 51	300	
Taffy	G. Friesland	Mature	7929 00	376 34	4 75	300	
Una	G. Friesland	Mature	8857 00	331 61	3 75	300	
London I	G Friesland	Mature	4672 00	240 71	5 15	300	B. Gietzmann Requeza Farm P.B 4, Gwelo.
Salisbury	G Friesland	4 years	7319.00	299 62	4 09	255	Government Demonstration Farm, Umshandige. Fort Victoria.
No 157	G. Red Poll	Mature	12043 60	463 81	3 85	300	Government Experiment Station, P B 19K, Bulawayo.
No. 191	G. Red Poll	Mature	8989 20	326 83	3 64	300	
No. 19	G. Friesland	Mature	7868.49	267 49	3 48	290	Grasslands Experiment Stn., Marandellas
No. 20	G Friesland	Mature	9615 00	385 76	4 01	300	

SEMI-OFFICIAL—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
No. 21	G. Friesland	Mature	8733.00	360.40	4.13	300	
No. 38	G. Friesland	Mature	10320.00	358.02	3.47	300	
No. 46	G. Friesland	4 years	8264.50	326.05	3.95	300	
No. 57	G. Friesland	4 years	9236.00	377.41	4 09	300	
No. 58	G. Friesland	4 years	8005.00	308 33	3.85	300	
No. 23	G. Friesland	Mature	6501 00	260.18	4.00	236	R. H. Greaves, Fountain, Nyamandhlovu.
No. 41	G. Friesland	Mature	6835.50	272.09	3 98	300	
Early Bird D 168	G. Friesland	3 years	8220.30	307.20	3 74	279	E. E. C. Green, Box 879, Bulawayo.
Breakfast	G. Guernsey	Mature	6324.00	249 99	3 95	300	Est. late A. J. Hanley, Newton Farm, Marandellas.
Bridget	G. Guernsey	4 years	8961.40	349 95	3 90	300	Mrs. L. M. H. Howard, Nengwa Farm, P.O. Beatrice.
Cecilia	G. Guernsey	3 years	6739.70	267.58	3.97	300	
Cimaron	G. Guernsey	4 years	6998 40	347 56	4.97	300	
Babs	G. Friesland	Mature	6755 50	248 22	3 67	276	D J. Huddy, Box 718, Salisbury.
Biscuit	G. Guernsey	4 years	5439.30	245 36	4 51	300	
Intombi	G. Friesland	Mature	6979 90	241 92	3.47	298	
Kufara	G. Friesland	Mature	7699 70	271.45	3.53	279	
Mnyaga	G. Friesland	Mature	6487.50	232.91	3.59	300	
Olga	G. Friesland	Mature	11397 80	379 48	3.33	300	
Rosebud	G. Friesland	Mature	8089 80	254.27	3.14	300	
Rosella	G. Friesland	Mature	10661.00	354.02	3.32	300	
Witklap II.	G. Friesland	Mature	7464.20	257 13	3.44	259	
Beatrice	G. Friesland	Mature	8638 90	309 57	3.58	293	L. Huddy, Box 924, Salisbury.
Bulawayo	G. Friesland	Mature	7506.90	232 00	3 09	266	
Mollie	G. Red Poll	Mature	5768.30	245 45	4.26	300	A. Patton Jamieson, Dunsappie, Theydon
No. 12	G. Friesland	Mature	6305.00	242.52	3.85	300	D. S. Kabot, Box 261, Bulawayo.
No. 13	G. Friesland	Mature	8557.00	391.05	4.57	288	
No. 35	G. Friesland	3 years	7484.00	284 70	3.80	298	
No. 54	G. Friesland	Mature	9247 00	316 61	3.43	300	
No. 66	G. Friesland	Mature	11869 00	429 16	3.62	300	
No. 81	G. Friesland	Mature	8943 00	334.06	3.74	300	
No. 87	G. Friesland	Mature	8084 00	297.22	3.68	300	

D. 8	G	Friesland	Mature	9296.60	315.42	3.39	284	B H. Kew, Box 972, Bulawayo.
No. 9	G	Friesland	Mature	5998.90	248.06	4.13	284	
K. 16	G.	Friesland	Mature	6679.10	277.44	4.15	279	
K. 18	G.	Friesland	Mature	9118.60	333.22	3.65	300	
K. 15	G.	Friesland	Mature	7895.90	309.21	3.93	269	
Bauhinia	G.	Friesland	Mature	8771.00	340.45	3.89	266	D. King, Rockwood Farm, Concession.
Clare	G.	Friesland	Mature	8695.80	361.20	4.16	291	
Johan	G.	Friesland	Mature	7901.90	286.49	3.63	278	
Kolmeis	G.	Friesland	Mature	7142.10	251.24	3.52	300	
Topsy	G	Friesland	Mature	6977.00	237.03	3.40	237	
Monkey Nuts II	G	Friesland	3 years	7034.50	270.53	3.85	300	H. A. Knill, Mendamu, Marandellas.
No. 2	G.	Friesland	3 years	5951.80	225.71	3.79	300	H. T. Lay, P B. 107C, Salisbury.
No. 15	G	Friesland	Mature	6486.40	262.04	4.04	300	
No. 30	G.	Friesland	Mature	7230.80	256.05	3.54	300	
Barney	G	Friesland	Mature	9490.70	329.66	3.47	300	P. Linton, Box 898, Salisbury.
Beans II.	G	Friesland	Mature	8451.10	322.93	3.82	300	
Blake I.	G.	Friesland	Mature	4415.00	232.80	5.27	300	
Jempee III.	G.	Friesland	Mature	8405.60	333.08	3.96	300	
Laidon	G	Friesland	3 years	6152.30	238.89	3.88	300	
Mary I.	G	Friesland	Mature	7628.20	280.26	3.67	300	
Morley III.	G	Friesland	Mature	8195.30	303.75	3.71	300	
Sedina	G.	Friesland	Mature	7954.80	331.93	4.16	300	
Spot I.	G	Friesland	Mature	7637.50	303.45	3.97	300	
Thompson	G	Friesland	Mature	8239.30	317.03	3.84	300	
Jessie	G	Friesland	Mature	7230.50	266.27	3.68	300	J. N. L MacIlwaine, Box 23, Marandellas.
Madge	G	Friesland	3 years	7306.00	247.67	3.39	300	
Whinburn Argosy	P.B.	Friesland	3 years	6007.50	245.15	4.08	300	
Whinburn Echo	P.B.	Friesland	2 years	8215.00	320.36	3.90	300	
Whinburn Dew	P.B.	Friesland	Mature	6906.50	293.44	4.41	237	
Whinburn Hornbill	P.B.	Friesland	4 years	7653.00	275.39	3.59	300	
Buttercup	G.	Ayrshire	Mature	7230.00	286.66	3.97	300	J. MacIntyre, Box 58, Shamva.
Grace	G	Friesland	Mature	8544.00	290.30	3.40	300	
Lelia	G	Jersey	Mature	8521.90	434.59	5.10	300	Lt.-Col C. I. F. Maynard, Melfort, P.B. 112C, Salisbury.
Betty	G.	Friesland	4 years	6122.90	259.30	4.23	290	J H. McLean, Box 161, Gwelo
Bulawayo I	G	Friesland	Mature	5884.30	242.36	4.12	300	
Fork	G	Friesland	Mature	9484.40	351.88	3.71	300	

SEMI-OFFICIAL.—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
Hopman	G. Friesland	4 years	7360.30	283.74	3.86	300	
Liza	G. Friesland	4 years	7401.50	299 48	4.05	300	
Nora	G. Shorthorn	Mature	6129 30	248.67	4.06	300	
Regop	G. Ayrshire	Mature	6103.20	225 90	3.70	300	
Tomby II	G. Friesland	Mature	6057.00	265.60	4.39	300	
No. 2	G. Friesland	Mature	9970.20	308.28	3.09	300	L. McLean, Box 161, Gwelo.
No. 3	G. Friesland	4 years	7144.40	270.03	3.78	300	
No. 8 Flash	G. Friesland	Mature	6755.40	252.69	3.74	235	
G. 30/0	G. Friesland	Mature	9269.00	284.84	3 07	300	Meikles Trust & Invest. Co., Ltd., Leachdale Farm, Shangani.
Olive	G. Red Poll	Mature	7344 00	266.33	3 63	300	C. F. Mitchell, Box 1027, Bulawayo.
Daisy	G. L.R./Shorthorn	Mature	5518.40	229.38	4 16	254	C Moorhouse, Odzi Drift, Box 9, Umtali.
Olga	G. Friesland	Mature	5095.50	235.06	4 61	300	Com E. L. Morant, Box 741, Salisbury.
Crescent	G. Friesland	3 years	7598.50	311.32	4 10	300	C. F. S Morkel, Two Streams, P.O. Macheke.
Fay	G. Friesland	Mature	6729 00	239 57	3 56	300	F. B. Morrisby, Box 36, Gwelo.
No. 78	G. Friesland	Mature	7791 00	255.95	3 29	300	
No. 86	G. Friesland	Mature	9751 00	311.10	3.19	300	
No. 102	G. Friesland	Mature	7422 00	233.62	3 15	300	
No. 152	G. Friesland	Mature	11209.00	368.49	3 29	300	
No. 161	G. Friesland	Mature	7776.00	250.97	3 23	300	
Bell III.	G. L.R./Shorthorn	2 years	8481.70	314 95	3.71	271	E. Palmer, Ferndale, Penhalonga.
Nellie	G. L.R./Shorthorn	3 years	5506.30	236.12	4.29	255	
Peggy III.	G. L.R./Shorthorn	4 years	6437 80	328.79	5 12	297	
Petal	G. Friesland	Mature	7838 10	365.25	4.66	271	
Blackie	G. L.R./Shorthorn	Mature	6356 30	270.33	4 25	300	
Polly	G. Shorthorn	Mature	6252 60	278.97	4.46	300	
Dans	G. Friesland	Mature	14520 00	486.16	3.35	300	Mrs. M. Parsons, Box 7, Bulawayo.
Ivy	G. Friesland	Mature	7908.50	304.26	3.85	300	
Stella	G. Friesland	3 years	7994 50	293.08	3 67	300	

No. 16 A.	G. Friesland	3 years	5980 50	237 29	3 97	300	T. C. Pascoe, Box 1253, Salisbury.
No. 46	G. Friesland	Mature	8067 00	299 03	3 71	257	
No. 97	G. Friesland	Mature	8194 50	274 44	3.35	300	
No. 103	G. Friesland	Mature	7687 00	278 14	3 62	292	
No. 110 A.	G. Friesland	3 years	7279.50	267 39	3 67	300	
No. 132	G. Friesland	Mature	6811.00	288.50	4 24	300	
No. 24	G. Friesland	Mature	7691.00	266 08	3 33	300	J. Picken, Iron Mine Hill Farm, P O Iron Mine Hill.
No. 51	G. Friesland	4 years	8369 00	349 98	4 18	300	
Camperdown	G Friesland	Mature	6489 20	245 25	3 78	256	P. J Pretorius, Box 55, Selukwe.
Farmers' Co-op.	G. Friesland	3 years	6596.10	259 66	3.94	300	
Fivebob	G. Friesland	Mature	5648.70	244 02	4 32	243	
Zingwe	G. Friesland	4 years	6405.50	307.80	4 81	300	
Bettafina	G Friesland	Mature	8092 60	276.50	3 42	300	Red Valley Estate, Lushington, Marandellas
Cheepy	G. Friesland	Mature	7963 10	274 19	3 44	300	Mrs. M. Rogers, Bickford, Gwelo.
Danga	G. Friesland	Mature	7266.50	275 48	3.81	300	
Mickie	G Friesland	5 years	7801 50	247 16	3 17	300	
Orvorn	G Friesland	Mature	6455 00	238.19	3 53	300	
Betty	G Ayrshire	3 years	5641 80	242 22	4 29	300	S. M. Sinclair, Albany, P B. Melsetter.
Mahombwe	G. Ayrshire	3 years	5331 50	233 73	4 38	300	
Mary	G. Ayrshire	4 years	7081 70	233 73	3 30	300	
Cathrine VII	G Friesland	2 years	6132 00	245 23	4 00	300	E Stanger, Chimbi Source, Rusape.
Nyama II.	G Friesland	Mature	5785 00	242.09	4.18	300	
Zimbiti	G. Friesland	Mature	5439.00	227 85	4 19	296	
Blackie	G Friesland	Mature	8057.00	267 53	3 32	300	Mrs. V Stead, Arizona, Box 56, Gwelo.
Cathleen	G. Friesland	Mature	8076 00	379.35	4 70	277	
Chloe	G Friesland	3 years	7228.50	240 92	3 33	300	
Rowan I.	G. Friesland	Mature	7409 00	225 41	3 04	300	
G. 1	G. Ayrshire	Mature	9097 00	373.77	4.11	300	J R. Stewart & Sons, Ltd. Battle Farm, P O. Shangani.
G. 22	G Ayrshire	3 years	5928 00	231 33	3 90	272	
Katherine	G Friesland	3 years	5199 20	275 25	5 29	294	H Stobart, Atlanta, Arcturus.
Betty	G. Ayrshire	Mature	8341 00	270 17	3.24	300	Susman & Newfield, Box 959, Salisbury.
Doreen	G Friesland	Mature	8859 00	304.58	3 44	300	
Gracie	G Friesland	4 years	7899 00	264.21	3 34	300	
Julia A	G Friesland	Mature	8643 00	313.64	3 63	300	
Kandy	G Friesland	Mature	8303 00	270 77	3 26	300	

SEMI-OFFICIAL—(Continued).

Name of Cow.	Breed.	Age	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
Loafer	G. Friesland	4 years	6306.00	231.15	3.67	300	
Noria	G. Friesland	3 years	6231.00	258.18	4.14	300	
Pride	G. Friesland	4 years	6384.00	230.41	3.61	300	
Queenie	G. Friesland	3 years	7010.00	262.28	3.74	282	
Rhoda	G. Friesland	4 years	7536.00	269.54	3.58	300	
Salisbury	G. Friesland	4 years	7321.00	245.13	3.35	300	
Tap	G. Friesland	4 years	6989.00	262.62	3.76	300	
Vivianne	G. Friesland	Mature	8213.00	302.93	3.69	300	
Bluey	G. Friesland	Mature	6943.90	306.21	4.41	300	H. Swaine, Box 131, Gwelo.
Agnes	G. Friesland	4 years	5801.50	256.51	4.42	270	Est late Mrs. J G. Taylor, Box 55, Selukwe.
Agnes III.	G. Friesland	Mature	5914.20	265.75	4.50	270	
Home Farm	G. Friesland	Mature	5888.10	276.04	4.69	270	
Hotel	G. Friesland	3 years	6258.70	227.81	3.64	300	
January	G. Friesland	Mature	7064.10	290.36	4.11	265	
Kafela	G. Friesland	4 years	7041.80	278.32	3.95	300	
Thornhill	G. Friesland	Mature	7025.10	267.44	3.81	300	
Training Camp	G. Friesland	Mature	6957.00	277.37	3.99	284	
Twins	G. Friesland	Mature	7991.50	255.88	3.20	300	
Ghenna	G. Friesland	Mature	5779.80	266.00	4.60	292	A. W. Tennent, Kelvin, Headlands.
Jeannie	G. Friesland	Mature	6448.30	237.45	3.68	292	
Agrin	G. Red Poll	Mature	6992.50	266.74	3.81	300	J. G Thurlow, Atherstone, Bindura.
Dorika III.	G. Red Poll	4 years	5873.90	324.81	3.84	261	
England	G. Friesland	Mature	8335.20	347.33	4.17	300	
Nyama	G. Red Poll	Mature	6445.40	244.87	3.81	283	
Whitfield Nancy II.	G. Friesland	23 months	5680.00	235.13	4.14	300	P S. Timms, Chitora, Rusape.
No. 138	G. Red Poll	Mature	5915.00	256.64	4.34	300	A. M Tredgold, P.B. 61L, Bulawayo.
No. 190	G. Red Poll	Mature	6612.50	254.30	3.85	300	
No. 192	G. Red Poll	Mature	7433.00	302.39	4.07	285	
No. 245	G. Red Poll	Mature	7000.00	273.35	3.91	300	
Gloria	G. Friesland	2 years	8384.10	260.32	3.10	300	Mrs. M. Turnbull, Box 479, Bulawayo.
Cinderella	G. Friesland	Mature	6442.00	231.54	3.59	289	Miss I. E. van Niekerk, Claremont, Inyanga, P B. Rusape.
Mere Lavender	G. Friesland	Mature	7623.00	230.20	3.02	300	R. O. Waldschutz, Mere, Box 27, Marandellas.

Southern Rhodesia Veterinary Report

JUNE, 1948.

General. Grazing has been good and cattle are in fair condition.

Tick Life is reported to be decreasing in activity though still very prevalent in the Salisbury and Gwelo districts.

Diseases. African Coast Fever:

Salisbury District. No cases on any of the infected farms.

Melsetter and Chipinga Districts. No cases on any of the infected farms.

Anthrax. One case was reported in the Salisbury district and inoculations carried out in the Fort Victoria district.

Trypanosomiasis. One death reported from Mtoko, 30 cases in the Chipinga district and 1 in the Melsetter district.

Lumpy Skin Disease. A few cases reported in the Salisbury, Gwelo and Fort Victoria districts.

Quarter Evil occurred in the Salisbury, Bulawayo, Gwelo and Melsetter districts.

Epi-Vaginitis. 73 cows were found to be infected in the Salisbury district.

Theileriosis. All farms infected in the Salisbury district now out of quarantine.

Heart Water. No cases reported.

Anaplasmosis. Eleven cases reported in the Salisbury district.

Piroplasmosis. 15 cases reported in the Salisbury district.

Stiff Sickness is still general in the Umtali district.

Sweating Sickness causing loss of cattle in the Bulawayo district.

Horse Sickness. 3 cases reported in the Salisbury district.

Scab. Sheep and goats reported infected in the Chilimanzi Reserve, Fort Victoria district.

Foot and Mouth Disease. No fresh outbreaks occurred during the month and there was no active infection at any of the previously infected centres.

Mallein Testing. 175 horses were tested with negative results.

Tuberculin Testing. 21 bulls, 8 cows, 47 heifers and 8 yearlings were tested with negative results.

IMPORTATIONS.

Union of South Africa: Horses and mares 66, geldings 114, bulls (breeding) 25, cows and calves (breeding) 73, mules 4, pigs (breeding) 1, sheep (slaughter) 52.

Bechuanaland Protectorate: Oxen (slaughter) 766, cows (slaughter) 18, bulls (slaughter) 13.

EXPORTATIONS.

Portuguese East Africa: Oxen (slaughter) 52.

Northern Rhodesia: Cows and Calves (breeding) 14, donkeys 17, geldings 1, pigs (breeding) 1.

EXPORTATIONS—MISCELLANEOUS.

In Cold Storage.

United Kingdom: Poultry 12,001 lbs.

Union of South Africa: Dripping and Fat 2,589 lbs.

Northern Rhodesia: Offal 9,958 lbs., beef 289,604 lbs., veal 111 lbs., sausage 5,930 lbs., dripping and fat 1,737 lbs., bacon 10,056 lbs., mutton 3,304 lbs., gammon 1,587 lbs., ham 80 lbs.

Bechuanaland Protectorate: Offal 362 lbs., beef 211 lbs., sausage 525 lbs., bacon 283 lbs., pork 132 lbs., brawn 3 lbs.

Belgian Congo: Goat meat 3,243 lbs., offal 17,588 lbs., beef 535,836 lbs., veal 131 lbs., mutton 118 lbs.

Meat Products from Liebig's (Rhodesia) Ltd., West Nicholson.

Union of South Africa: Oxford sausage 2,376 lbs., Vienna sausage 34,500 lbs., Ideal Quick Lunch 9,600 lbs., curried beef 22,800 lbs., potted beef 1,450 lbs., ox bungs 1,121 lbs., beef middles 595 lbs., weasands 83 lbs.

Belgian Congo: Corned beef 24,840 lbs., Oxford sausage 360 lbs., Ideal Quick Lunch 240 lbs., steak and kidney 240 lbs.

JULY, 1948.

General. Grazing has remained plentiful and cattle, with the exception of the Melsetter District, are in good condition.

Tick Life. Is reported to be active in most districts.

Diseases. African Coast Fever:

Salisbury District. No cases on any of the infected farms

Melsetter and Chipinga Districts. No cases on any of the infected farms.

Foot and Mouth Disease. No fresh outbreaks occurred during the month and there was no active infection at any of the previously infected centres, consequently reductions in quarantine areas were made in several districts.

Epi-Vaginitis. Salisbury District. Infected animals were destroyed on three farms totalling 2 bulls and 88 cows. Treatment of the females on four other infected farms is being carried out.

Anthrax. Was diagnosed in Salisbury District, where two deaths occurred. The infected herds were inoculated and eight adjoining farms were immunized as a protective measure.

Trypanosomiasis. One death reported from Mkota Reserve and 13 cases in the Chipinga District.

Lumpy Skin Disease. A few mild cases occurred in the Salisbury, Gwelo and Fort Victoria Districts.

Quarter Evil. Seven outbreaks were reported in the Salisbury District resulting in 21 deaths Cases were also reported from Bulawayo, Gwelo and Melsetter Districts.

Heart Water. Was reported in the Fort Victoria District.

Anaplasmosis. 15 deaths were reported in the Salisbury District.

Piroplasmosis. 11 deaths were reported in the Salisbury District.

Horse Sickness. 9 deaths were reported in the Salisbury District.

Mallein Testing. 110 horses were tested with negative results.

Tuberculin Testing. 1 bull was tested, negative result

IMPORTATIONS

Union of South Africa: Bulls (breeding) 6, horses and mares 23, geldings 87, sheep (breeding) 2.

United Kingdom: Pigs (breeding) 6.

EXPORTATIONS.

Portuguese East Africa: Bulls (breeding) 20, oxen (slaughter) 18, pigs (breeding) 1, goats (slaughter) 80.

Northern Rhodesia. Bulls (breeding) 20, donkeys 20.

EXPORTATIONS—MISCELLANEOUS.

In Cold Storage.

Union of South Africa: Offal 20,001 lbs., dripping and fat 4,248 lbs., ham 3,387 lbs.

Northern Rhodesia: Offal 2,101 lbs., beef 261,425 lbs., sausage and polony 5,954 lbs., dripping and fat 1,278 lbs, bacon 20,058 lbs., gammon 1,118 lbs., ham 60 lbs.

Bechuanaland Protectorate: Offal 148 lbs., beef 23 lbs, sausage and polony 507 lbs., bacon 218 lbs, gammon 7 lbs., brawn 4 lbs.

Belgian Congo: Offal 6,272 lbs., beef 393,203 lbs.

Meat Products from Liebig's (Rhodesia) Ltd., West Nicholson.

Union of South Africa: Oxford sausage 1,224 lbs., Vienna sausage 9,000 lbs., curried beef 16,800 lbs., potted beef 675 lbs., jellied beef 6,300 lbs.

Belgian Congo: Corned beef 31,680 lbs., Oxford sausage 432 lbs., Vienna sausage 465 lbs., curried beef 24 lbs., pate de Foie 73 lbs.

AUGUST, 1948.

General. Grazing deteriorated in some districts and cattle were in fair condition.

Tick Life. Is reported to be active in most districte

Diseases. African Coast Fever:

Salisbury District. No cases on any of the infected farms.

Melsetter and Chipinga Districts. No cases on any of the infected farms.

Foot and Mouth Disease. No outbreaks occurred during August. A Veterinary Unit consisting of one Veterinary Officer and three Animal Health Inspectors was despatched to Bechuanaland to assist in inspection work in consequence of an outbreak of foot and mouth disease in that territory. Rhodesian cattle were removed from the Bechuanaland border and a police cordon is being placed along the border.

Epi-Vaginitis. One bull and nine cows were found infected on one farm in the Salisbury district.

Anthax. Was diagnosed in the Fort Victoria District, where two deaths occurred.

Trypanosomiasis. Was confirmed on the border of the Fort Victoria District and Portuguese East Africa. The deaths were 38 donkeys and 20 sheep and goats.

Lumpy Skin Diseases. Fairly severe cases occurred on two farms in the Gwelo District.

Quarter Evil. Seven outbreaks were reported in the Salisbury District resulting in 21 deaths. Cases were also reported from the Bulawayo, Umtali, and Fort Victoria Districts.

Anaplasmosis. Was reported in the Salisbury, Bulawayo, Umtali and Fort Victoria districts.

Piroplasmosis. Eight deaths were reported in the Salisbury district.

Scab. Outbreaks occurred among sheep in the Inyanga and Fort Victoria districts.

Red Water. In the Gwelo and Fort Victoria districts two cases in each district were reported.

Mallein Testing. Sixty-one horses were tested. There were no reactors.

Tuberculin Testing. Twenty-two bulls, 12 cows, 57 heifers There were no reactors.

IMPORTATIONS.

Union of South Africa: Geldings 45, bulls (breeding) 40, cows and calves (breeding) 49, horses mares 2.

Northern Rhodesia: Horses and mares 1.

EXPORTATIONS.

Portuguese East Africa: Oxen (slaughter) 48.

Nyasaland: Pigs (breeding) 7.

Northern Rhodesia: Pigs (breeding) 1.

EXPORTATIONS—MISCELLANEOUS.

In Cold Storage.

United Kingdom: Offal 10,025 lbs., poultry 4,730 lbs.

Northern Rhodesia: Offal 9,643 lbs., beef 306,337 lbs., sausage and polony 5,954 lbs., dripping and fat 2,951 lbs., bacon 16,655 lbs. gammon 702 lbs., ham 60 lbs.

Bechuanaland Protectorate: Offal 134 lbs., beef 22 lbs., sausage and polony 270 lbs., bacon 196 lbs., gammon 7 lbs., brawn 13 lbs., pork 100 lbs.

Belgian Congo: Offal 24,614 lbs., beef 50,899 lbs., veal 1,060 lbs

Meat Products from Liebig's (Rhodesia) Ltd., West Nicholson

Union of South Africa: Vienna sausage 1,500 lbs.

Belgian Congo: Corned beef 16,200 lbs., Oxford sausage 360 lbs., Ideal Quick Lunch 240 lbs., steak and kidney 240 lbs. marrow fat 315 lbs.

SEPTEMBER, 1948.

General. Grazing was reported to be plentiful in some districts but poor in other districts and cattle were in fair condition.

Tick Life. Active in all districts.

Diseases. African Coast Fever:

Salisbury District. No cases on any of the infected farms.

Melsetter and Chipinga Districts. No cases on any of the infected farms.

Foot and Mouth Disease. No fresh outbreaks were reported. Southern Rhodesian staff continue to operate in Bechuanaland assisting in the control of the outbreak there.

Epi-Vaginitis. Five bulls and 38 cows were found infected in the Salisbury District.

Artificial Insemination was commenced on a farm in this district, and nine cows had been inseminated at the end of the month.

Anthrax. Was diagnosed in the Salisbury and Fort Victoria Districts.

Trypanosomiasis. One case (a horse) was confirmed in the Chipinga District.

Lumpy Skin Disease. A few mild cases occurred in the Gwelo District.

Quarter Evil. Was reported from all districts.

Anaplasmosis. Confirmed in the Salisbury District.

Piroplasmosis. Confirmed in the Salisbury and Bulawayo Districts.

Red Water. An outbreak of a virulent type occurred in the Umtali District. One case reported in the Fort Victoria District.

Paratyphoid. Reported on various farms in the Fort Victoria District.

Mallein Testing. 89 horses and 2 mules were tested. There were no reactors.

Tuberculin Testing. 28 bulls, 13 cows, 39 heifers and 2 yearlings were tested. There were no reactors.

IMPORTATIONS.

Union of South Africa: Cows and calves (breeding) 54, mules 2, horses and mares 27, geldings 72, bulls (breeding) 24, sheep (breeding) 52.

United Kingdom: Pigs (breeding) 7.

EXPORTATIONS.

Nyasaland: Geldings 3.

Northern Rhodesia: Pigs (breeding) 8, geldings 1.

Union of South Africa: Geldings 4, pigs (breeding) 6.

Portuguese East Africa: Slaughter oxen 15, slaughter cows 1, bulls (breeding) 2.

Belgian Congo: Geldings 9.

EXPORTATIONS MISCELLANEOUS.

In Cold Storage.

United Kingdom: Neats foot oil 5 lbs.

Union of South Afric: Dripping 19,879 lbs., offal 6,006 lbs., sausage casings 6,985 lbs.

Bechuanaland Protectorate· Beef 27 lbs., sausage and polony 186 lbs., pork 92 lbs., dripping 377 lbs., offal 395 lbs., bacon 176 lbs., gammon 255 lbs.

Meat Products from Liebig's (Rhodesia) Ltd., West Nicholson.

Union of South Africa: Corned beef 288,000 lbs., Oxford sausage 13,800 lbs., Vienna sausage 42,000 lbs., Ideal Quick Lunch 19,800 lbs., steak and kidney 12,000 lbs., curried beef 4,200 lbs., potted beef 2,700 lbs.

Belgian Congo: Corned beef 22,800 lbs., Oxford sausage 360 lbs. Vienna sausage 1,050 lbs., dripping 1,260 lbs.

P. D. HUSTON,

Director of Veterinary Services.

SOUTHERN RHODESIA

Locust Invasion, 1932-48

Monthly Report No. 189: July, 1948.

Red Locusts: *Nomadacris septemfasciata Serv.*

No Red Locusts in any stage of development within the Colony were reported

J. H. WHELLAN,
For Chief Entomologist

Monthly Report No. 190: August, 1948

Red Locusts: *Nomadacris septemfasciata Serv.*

No Red Locusts in any stage of development within the Colony were reported.

J. H. WHELLAN,
For Chief Entomologist.

MONTHLY REPORT No. 191: SEPTEMBER, 1948

Red Locusts: *Nomadacris septemfasciats serv.*

No Red Locusts in any stage of development within the Colony were reported.

MERVYN C. MOSSOP,
Chief Entomoligst.

MONTHLY REPORT No. 192: OCTOBER, 1948

Red Locusts: *Nomadacris septemfasciata Serv.*

No Red Locusts in any stage of development within the Colony were reported.

M. C. MOSSOP,
Chief Entomologist.

THE RHODESIA

Agricultural Journal

Vol. XLV. No. 6 November-December, 1948.

Editorial

Notes and Comments

RECENT DEVELOPMENT IN THE CONTROL OF WEEDS.

The May 1948, issue of the Journal of the Royal Horticultural Society published a lecture given by Professor G. E. Blackman, of the Department of Agriculture, University of Oxford, on the above subject.

In 1896 a Frenchman Bonnet demonstrated that when dilute copper sulphate was sprayed on a crop of oats, then the yellow charlock growing in the oats died whereas the oats remained uninjured.

In 1911 Rabaté showed that dilute sulphuric acid spray could kill a large number of dicotyledenous weeds without seriously injuring a cereal crop. Sulphuric acid is dangerous to handle and care must be taken to add the acid to the water and not the reverse. Commercial 77 per cent. acid is used under the name of "B.O.V.," which is more foolproof since less heat is generated, if water is added by mistake the reverse way round. Experiments with dilute sulphuric acid were tried out in Britain in 1932.

Also at this time an important step in weed control was taken. A yellow dye-stuff, dinitro-ortho-cresol or D.N.O.C., was experimented with by two Frenchmen, Truffaut and Pastac, who showed that when cereals were sprayed by this dye some of the weeds were killed but the crop remained uninjured. This yellow dyestuff was first synthesised in Russia in 1866 and is still used as a dye for silk.

About 1939 a search was made among other copper compounds for effective weed killers and copper chloride proved more efficient than copper sulphate. Copper chloride has the advantage of being non-toxic to human beings, non-corrosive to clothes, but on the other hand it is more corrosive to spraying machinery than sulphuric acid. Sulphuric acid, although important in commercial horticulture is not so beneficial to the garden, as special equipment is necessary. Copper chloride is easier to handle than sulphuric acid, but many weeds which are killed by sulphuric acid are resistant to copper chloride.

Templeman made a most interesting discovery in 1940. He observed that one of the growth substances when sprayed on to pots of oats in which there were some chance yellow charlock plants, killed the charlock but not the oats. The growth substance used was alpha-naphthyl acetic acid, one of the substances used for making cuttings root faster. Following upon this discovery two very active substances were selected at the end of 1942, namely, 2-methyl-4-chloro-phenoxyacetic acid (M.C.P.A.) and 2-4-dichloro-phenoxyacetic acid (D.C.P.A.).

The following table shows the inter-relationship between the toxicity of the herbicide and the species and the percentage kill at varying spray concentrations.

	Goose-grass.* Conc.†	Kill	Corn Poppy. Conc.	Kill	Shepherd's Needle. Conc.	Kill	Scentless Wayweed. Conc.	Kill
	%	%	%	%	%	%	%	%
Sulphuric acid ...	9.2	50	9.2	9	9.2	16	9.2	16
	13.8	94	13.8	58	13.8	6	13.8	32
	18.4	95	18.4	52	18.4	18	18.4	55
Copper chloride ..	1.0	26	0.5	0	0.5	33	2.0	25
	2.0	66	1.0	0	1.0	0	4.0	36
	4.0	83	2.0	19	2.0	0	6.0	40
Dinitro-ortho-cresol...	0.3	10	0.28	94	0.3	53	0.3	49
	0.6	74	0.55	91	0.7	49	0.6	85
	0.9	78	1.10	98	1.1	64	0.9	86
Methyl-chloro-phenoxy-acetic-acid	0.1	0	0.05	63	0.05	96	0.2	37
	0.2	0	0.15	86	0.15	100	0.4	40
	0.4	0	0.45	98	0.45	100	0.6	46

* Goosegrass = *Galium aparine;* Corn Poppy = *Papaver rhoeas;* Shepherd's Needle = *Scandix pecten-veneris*; Scentless Wayweed = *Matricaria inodora.*

† All concentrations expressed on a weight-volume basis.

The relative efficiency of sulphuric acid, copper chloride D.N.O.C. and the growth substance M.C.P.A. is quite different with different weeds.

Sulphuric acid has been used for weed control in onions and leek crops. Onions are similar to cereals in their habit of growth. The leaves of both are waxy and the habit of growth upright. The growing tissues are basal and protected by leaf sheaths. The waxy coating prevents penetration and the droplets run off the leaves and the meristems do not come in contact with the spray. Most dicotyledenous weeds on the other hand have flat waxless leaves which hold the spray and the growing point being at the apex it is exposed and vulnerable. There was no mean difference in yield between the sprayed and hand weeded plots. Use of a wetting agent slightly reduced the yield on an average. Where a second spraying was necessary it meant a 11% reduction in yield or a 16% reduction if a wetting agent were used

The experiments on onion crops were carried out in gravel soils near London and they proved that as far as these soils were concerned it was not necessary to hoe onion crops which had been treated with sulphuric acid Experiments have further shown that there is an optimum time to spray each crop and each weed.

Herbicides are very effective weed killers in lawns, but their action is slow and very often repeated applications are necessary

So far no successful technique has been found for ridding the majority of vegetable crops of weeds as D.N.O.C. and growth substances kill most of the common vegetables. Experiments are being conducted on the possibility of selective weed control in crops such as parsnips and carrots using light mineral oils of the kerosene type. The difficulty is to get a standard guaranteed grade of kerosene as at present supplies from various parts of the world are bulked together In America there are local oil wells with refineries so that it is possible there to guarantee standard grades of kerosene. Another line of research is to ascertain what is the effective constituent in kerosene

It should be noted that when lawns are treated with weed killers the surrounding flower beds must on no account receive any spray.

FIELD CROP ABSTRACTS, published by the Commonwealth Bureau of Pastures and Field Crops, Aberystwyth, Great Britain.

Following on the recommendation of the Commonwealth Agricultural Bureau Conference in 1946, the information centre known as the Commonwealth Bureau of Pasture and Forage Crops is now called the Commonwealth Bureau of Pastures and Field Crops and a new journal, *Field Crop Abstracts* has been introduced, the first issue dated January, 1948.

Field Crop Abstracts will have six issues per year. January, March, May, July, September and November, and will alternate with and form a companion journal to *Herbage Abstracts*. The

first five issues contain author indices, and the sixth, author, subject, crop and geographic index.

This journal contains abstracted information relative to Land Utilisation and Management, Farming Systems, Crops and Crôp Production, Economics of Crop Production, Machinery and Equipment, Seeds, Diseases and Pests, Weeds, Cereals, Buckwheat, Legumes, Oil Crops, Fibre Crops, Sugar Beet, Root Crops, Plant Nutrition, Physiology, Plant Biochemistry Germination, Environmental Studies, Books and Reports.

In each section abstracts are taken from scientific literature of the various countries in the world.

Most farmers are familiar with the Journal entitled "Farm Mechanization," which forms a link between farming and engineering.

Special permission has been received by the publishers from the British Government to publish a new monthly journal, "British Farm Mechanization," with the next few months.

This new journal will have a section on the servicing of British tractors and implements and will also publish detailed descriptions of new machines and therefore will be of great interest to Rhodesian farmers.

The cost of the journal to any part of the world will be £1 4s. for 12 issues, post free, from the Temple Press, Ltd., London.

Retirements in the Department of Agriculture during 1948

The following Officers of the Department of Agriculture have retired during 1948:—

H. G. WHEELDON,
Chief Poultry Officer.

Mr. Wheeldon was appointed as Assistant Poultry Expert in 1922, he became Poultry Expert on the retirement of Dr. Little in 1929, and later his position was changed to Chief Poultry Officer as the branch grew.

He represented Southern Rhodesia at the Third World's Poultry Congress held in London in 1930.

Mr. Wheeldon had much to do with the establishment of the Poultry Industry in Southern Rhodesia, including Government Poultry Stations, Poultry Shows, marketing, and improved farming methods, and there are many farmers who have benefited by his advice and help who will wish him years of happiness and success in his retirement on his farm at Borrowdale, Salisbury.

S. D. TIMSON, M.C.

Mr. Timson joined the Agricultural Department as a Grain Inspector in 1925 and later became Assistant Agriculturist.

Most of his work was in an advisory capacity, mainly to farmers, on all agricultural matters.

Mr. Timson was a regular contributor to the "Rhodesia Agricultural Journal" and wrote on a wide variety of subjects, including The Castor Oil Plant, The Sunflower, The Groundnut, The Sweet Potato, etc., as well as providing notes on Farm Practice at the Government Farm, Gwebi. Perhaps his most outstanding contributions were his series of articles on Compost. The first article under this title appeared in the "Rhodesia Agricultural Journal" in 1936. It was he who introduced into Rhodesia the Indore Method of Compost Working from Indore, India. Farmers gradually adopted the idea and to-day its value in all forms of agriculture cannot be too strongly stressed.

Always of a retiring nature, Mr. Timson hated the limelight and carried out his various duties in a quiet, unassuming way and there is no doubt that he contributed in no small measure to the agricultural progress of this Colony.

Mr. Timson commenced investigations on witch weed control in 1929 and proved that it could be economically controlled and eradicated.

His many friends will wish him many happy years to enjoy his retirement and hope he will continue to write his interesting articles for the R.A.J.

H. C. ARNOLD, M.B.E.

Mr. Arnold was Manager of the Salisbury Experiment Station for 28 years.

During the time he was at the Experimental Station many new crops and new varieties of crops were tested and grown on the Station under his direction.

In 1944 he was awarded the M.B.E. for his valuable experimental and plant breeding work, particularly in the development of hybrid maize and breeding of soya beans and other crops on the station. As a further mark of acknowledgment of his good work done at the Experiment Station, the 1945 Congress of the National Farmers' Union put forward a proposition, which was approved by the Minister of Agriculture, that the new strains of velvet beans, characterised by late flowering and heavy vine growth, should be known as the Arnold Velvet Bean.

His genial manner and eagerness to help those who came in contact with him won for him many friends, who will all join in wishing him many happy years of retirement.

Annual Reports of the Government Farms

UMGUSA, GWEBI, UMSHANDIGE AND "GREAT B."

By D. E. McLOUGHLIN, Chief Agriculturist.

(It is not possible at present to print in full the Annual Report of the Chief Agriculturist for 1947. Meantime those sections dealing with the Government farms Umgusa, Gwebi, Umshandige and Great B (now known as the Archie Henderson Research Station) are published below.- Editor.)

UMGUSA TURKISH TOBACCO AND PLANT BREEDING STATION.

Mr. T. K. SANSOM, Plant Breeder.

The worst drought in the history of the Colony was experienced during the past season; on the above-named Station only 7.8 inches of rain fell, of which two inches fell in September and October.

It was not possible to plant until the 21st December. From this latter date until the close of the season only three inches were recorded; in spite of this, on the rotation and variety trials, good crops were reaped.

Rotation Trials. These trials have now completed their fourth season: a separate interim report covering the four seasons is to be compiled—the present report deals with the past season only.

Despite only three inches of effective rainfall, results were encouraging and satisfactory. The Gusi sand in Matabeleland has very considerable possibilities, and if properly managed can produce good crops on less than half the rainfall required for the heavier soils.

There are five rotations in duplicate, the fifth being a new rotation included for the first time this season Rotation 2 is a two course rotation, half of the plant is planted to maize receiving 150 lbs. of bone and super per acre, and the remaining half to legumes with no fertiliser; the remaining plot is fallowed.

Rotation 3 is a maize legume rotation in which the fertiliser is applied to the maize crop. Rotation 4 is also a maize legume rotation in which the legume receives the fertiliser (150 lbs. B. & S. per acre). Rotation 5, the new rotation, is a three course rotation of cowpeas, maize—half of the plot receiving 150 lbs. of B. & Supers per acre and the remaining half receiving 5 tons compost, plus 150 lbs. bone and super per acre, followed by half plots of ground nuts and sunflowers.

The yields were as high as 15,000 lbs. green weight per acre and 1,760 of grain in the case of maize and 13,090 lbs. green weight in the case of velvet beans.

In the new rotation—Rotation 5—the results were unsatisfactory; the cowpeas made satisfactory growth, but the maize receiving compost did not show up as well as was to be expected —in fact the ensilage and grain weights were lower than the half plot receiving 150 lbs. of bone and supers only. The ground nuts made satisfactory growth, but on lifting them it was found that the pods contained no seed, it having apparently been eaten by ants; the stand on the sunflower plot was extremely poor, but those plots surviving made very good growth.

Variety and Breeding Trials. Nineteen different varieties of maize and six varieties of sorghums and millets were under trial. Owing to the amount of seed available it was not possible to conduct proper variety trials, so that general conclusions only can be drawn.

In these trials seven strains of Hybrid maize from the Agricultural Experiment Station, Salisbury, and five strains of Reid Hybrids from the United States were included. The Hybrids from the Agricultural Experiment Station, Salisbury. showed great promise throughout the growing period, and had ensilage weights been taken it is certain that they would have yielded a good deal more than other varieties. The reaping results, though good, did not come up to expectations and these Hybrids were outyielded by Sharp's Potchefstroom Pearl. Of the five strains of Reid Hybrids only one, 134 T.H., showed any promise. The quick maturing strains, 90 and 110A especially, were almost a failure, but the season may have been largely the cause of this. Strains 90 and 110A were almost mature before the last good rains fell, so that they derived no beneficial effect from them, whereas the later maturing varieties and strains were able to make use of the last good rain of the season.

Five selfed strains were made from each of the nineteen varieties and strains.

A separate report on the hybrids from the Agricultural Experiment Station has already been compiled and a report on the Reid Hybrids will be forwarded in due course.

Of the six varieties of sorghums and millets under trial only two varieties have been retained for further trial, these two varieties are Perennial Sorghum and Sweet Corn (Hakdoorn) from Potchefstroom, the remainder made extremely poor growth, and although Perennial Sorghum and Hakdoorn made satisfactory growth their yields of green fodder can in no way be compared to that of the maize on the Gusi sands, in spite of the fact that they are considered to be better able to resist drought.

No variety of sorghum or millet yet tried out on Gusi sand at Umgusa has shown any signs of being able to give better ensilage or grain weights than maize; the search for new varieties will continue at Umgusa and at the Experiment Stations to be established next season at Matopos.

Lucerne and Vegetable Irrigation Trials. Lucerne and vegetable irrigation trials were started in March, but were subsequently abandoned. This was unfortunate, as these trials showed very great promise.

Twenty-four plots were laid out and sown to lucerne, the remaining twenty-four were planted to different varieties of vegetables.

The lucerne has shown very great promise. The vegetables also did extremely well; excellent crops of onions, potatoes, tomatoes, carrots, peas, beans, beetroot, cabbage, cauliflower, lettuce, leek, and spinach were grown.

Witstronk Silver King Maize. A small parcel of the above-named variety has been sown under irrigation for bulking up and distribution to farmers in the Gutu and Chatsworth areas for trial.

Returned Soldier Settlers. The returned soldier settlers on Umgusa Irrigation Scheme have been visited at regular intervals during the past season.

These settlers are concentrating mainly on the growing of truck crops, a very good practice owing to the extreme suitability of this area for these crops, and the proximity to the Bulawayo market.

As is to be expected the success of this venture varies according to the individual. Under proper guidance there is no reason whatever why the settlers under the Umgusa Irrigation Scheme should not make a great success of their holdings; they have everything in their favour, good soil which responds better than most soils to treatment, irrigation facilities and a ready market in Bulawayo for all that can be produced.

Visits of Officials from other Centres. Mr. Taylor, Vice-Principal of Cedara, and Mr. Hamblin, who was invited by the Government to report on an Agricultural Machinery Research Institute for the Colony, were taken on tours to various prominent farmers in the Bulawayo area.

Rhodes Matopos Estate. Charge was taken of all agricultural operations on the Government Farm, Matopos.

The maize crop has already been planted and the planting of the legumes will be completed before the end of the month.

Owing to the lateness of the season and to the fact that all seed has already been ordered there has been no change in the cropping programme as compared with previous years, but next season the whole cropping programme will be revised and brought into line with more modern ideas of crop programmes.

General. Owing to the extremely severe drought there was no great demand from farmers for visits, but already during the present season a number of requests have been received.

The present season has started in a most promising way, and except for isolated areas, the scars left by last year's drought

have already been healed, and if the season continues as it has begun Matabeleland can look forward to a very succesful farming year.

ANNUAL REPORT GOVERNMENT FARM, GWEBI, FOR THE YEAR ENDING 31st DECEMBER, 1947.

Mr. F. P. ORSMOND, Superintendent.

Climatic Conditions. The 1946-47 season commenced very favourably. All lands had been very well ploughed with D2 tractor. A No. 22 one-way disc was used to fertilise the lands, and everything was in readiness when the first rains broke on the 3rd November, 1946. By the 15th of the month 2.41 inches fell and planting commenced on the 16th. By the 26th November all maize for grain was planted. During this period, 16th 26th November, a further 1.38 inches fell, spread over four days, giving all the maize planted a good start.

The method employed in planting this season was to let the native labourers go ahead dropping the three seeds in each hole, in rows 6 feet apart by 18 inches. Three disc harrows, ox drawn, covered the seed. By this method all seed had as even a covering as possible. Thus the land also received a very effective first cultivation, resulting in a very even germination and weed free lands for three weeks. This gave the young maize plants every chance of getting away well.

A home made "Multiple Hitch" was constructed very cheaply, with four extended spring tooth harrow sections attached. This unit was drawn by the D2 tractor. By this method it was possible to cultivate 85 acres per day, thereby making it feasible to get over the lands when conditions were most favourable in a few days. Two cultivations by this method with an interval in between, followed up after the last cultivation by hand hoeing, was sufficient to keep the lands clean.

The rainfall totals for the season are given below:—

	Homestead.	Kopje Land.
November, 1946	4.05	4.28
December	3.49	5.17
January, 1947	1.84	1.93
February	4.85	3.82
March	6.19	3.92
April	.27	1.19
	20.69	20.31

The above rainfall is about 15 inches below normal for the season. A very severe drought was experienced from 26th December to the 18th February, setting the maize back very severely. Fortunately from 18th February onwards conditions improved considerably, turning what might have been a complete failure into a fair season as far as Gwebi was concerned. This is clearly shown in the crop figures that follow.

CROP YIELDS SEASON 1946-47.

Maize. 100 acre block south of the railway line.
2nd year maize after various green manure crops.

Plot No. 1	Yield 1946/47.	Yield 1945/46.
After sunn hemp and sunflowers	165 bags =8.5 bags per acre	10.7 b.p.a.
Plot No. 2		
After upright cowpeas and Niger oil	151 bags 83 lbs. =7.55 b.p.a.	7.3 b.p.a.
Plot No. 3		
After upright cowpeas and sunflowers	184 bags 52 lbs. =9.2 b.p.a.	11.4 b.p.a.
Plot No. 4		
After velvet beans ...	197 bags =9.89 b.p.a.	13.2 b.p.a.
Plot No. 5		
After sunn hemp and munga	174 bags 190 lbs. =8.8 b.p a.	9.6 b.p.a.
Kopje Land	Maize after green manure.	
129.66 acres ...	Yield	1,420 bags. =10.95 b.p.a.

Rotation Trials: Farm versus Hybrid Maize Seed. In the rotations this season the soya bean and sunflower plots were divided into three equal parts for comparison and to ensure that the maize was planted directly after both soya beans and sunflower, and that neither the hybrid seed nor the farm open pollinated seed maize followed either of these previous crops alone as was the case the previous season, thus giving a very unfair comparison.

The rotation trials have now been running for three complete seasons and since they were started in the season 1944-45 all the maize plots have been divided into two parts, one of which was planted to farm seed and the other to hybrids produced on the Salisbury Experiment Station. To obtain sufficient hybrid seed for this purpose it has been sometimes necessary to mix a number of strains, some of which were not entirely satisfactory, judging by their performance in previous yield trials. In future it is hoped that there will be sufficient seed available of the best strains.

Combining the yields obtained in Rotations B, C and D the hybrid seed has given the following increases expressed as a percentage of the yield of the farm seed.

Season 1944-45	16.3%
Season 1945-46	28.7%
Season 1946-47	18.2%
Average for 3 seasons	21.1%

The following tables show the yields and percentage increases obtained in each rotation for the different seasons. In none of the trials were the treatments replicated so that these figures are subject to soil variation, etc. No detailed figures are given for the season 1944-45 as the land had been treated uniformly prior to that year's planting

Rotation B (4 year). Maize-Sunn hemp for Hay.—Maize—½ plot. Soya Beans, ½ plot Sunnflowers.

Maize yields per acre in bags of 200 lbs. nett. Plots 4.75 acres each.

	Maize (after (Sunnhemp for Hay).			Maize (after Sunflowers).			Maize (after Soya Beans).		
	Hybrid	Farm.	% Inc.	Hybrid.	Farm	% Inc.	Hybrid.	Farm	% Inc
1945-46	9.40	7.54	24.7	—	6.94	—	10.46	—	—
1946-47	6.44	5.14	25.3	7.32	2.65	17.62	9.85	8.21	20.0
Average 2 seasons	7.92	6.34	25.0	—	—	—	—	—	—

Rotation D (4 year). Maize-Sunn hemp for Hay—Maize + Compost. ½ plot Sunflowers, ½ plot Soya Beans.

Plots 11.87 acres each.

	Maize Compost (after Sunn hemp for Hay).			Maize (after Sunflowers).			Maize (after Soya Beans).		
	Hybrid	Farm.	% Inc	Hybrid.	Farm.	% Inc.	Hybrid	Farm.	% Inc
1945-46	13.40	11.38	17.8	—	5.16	—	6.37	—	—
1946-47	8.63	8.09	6.7	4.39	3.62	21.3	8.74	5.98	46.2
Average 2 seasons	11.01	9.73	13.2	—	—	—	—	—	—

Rotation C (5 year). ½ plot Sunflowers. ½ plot Soya Beans. Sunn hemp for hay, Maize, Green Manure, Sunn hemp and Munga. Maize.

Plots 9.5 acres each.

In the season a planting error was made in the rotation and the one maize crop in 1945-46 was sown after maize instead of following the hay crop.

	Maize (after legume for Hay).			Maize (after Green Manure).			Maize (after Maize).		
	Hybrid.	Farm	% Inc.	Hybrid.	Farm.	% Inc.	Hybrid.	Farm.	% Inc
1945-46	—	—	—	10.87	9.67	12.4	9.17	4.91	86.8
1946-47	5.73	5.48	4.5	13.84	12.13	14.1	—	—	—
Average 2 seasons	—	—	—	12.35	10.90	13.3	—	—	—

It seems likely that the percentage increase which can be expected from hybrid seed will vary both with the season and according to the crop which follows. With this second factor is bound up the general question of the state of the soil, whether it is in good heart and of high fertility. The evidence in these

trials is still too small to come to any detailed or definite conclusions.

Total maize yields were as follows:—

Broadbalk East	20 acres	185 bags 90 lbs.
Broadbalk West	52.24 acres	393 bags 72 lbs.
100 acre block... ...	100 acres	871 bags 125 lbs.
Kopje Land ..	129.66 acres	1,420 bags
Rattray's Trials ..	6.5 acres	46 bags 190 lbs.
	308.4 acres	2,917 bags 77 lbs.

Side Crops. 57.12 acres were planted to sunn hemp for hay and again reaped by reaper and binder. The crop this season, although germination was good, produced a less bulky crop than last year. A great deal of leaf was lost waiting for the binder to be returned by the Drought Relief Committee who had borrowed it to cut hay at Norton. The average yield was under 1 ton per acre, or about 50½ tons less than last season.

Oats. 12.2 acres were planted to oats, and although it was intended to cut this crop with a combine so much time was spent in repairing the combine that it became necessary to reap the oats with the reaper and binder when the oats were really beyond the stage for cutting and stooking. Consequently quite an appreciable amount of grain was lost.

The yield was only 28 bags=2.2 b.p.a

Ground Nuts (Broadbalk East). Only 10 acres were put down to ground nuts this season, as the remaining 10 acres went down to potatoes.

This crop this season did very much better than last year, being quite Blight free as well.

Total yield of 308 bags=30.8 b.p.a.

Potatoes. This has been a very disappointing crop this season. Due firstly to the drought, which caught the crop in the flowering stage, and secondly due to damage by caterpillars and tuber moth.

The 10 acres on B Balk East only gave an average yield of 10 bags per acre.

The 13.4 acres south of the railway line were a little better with a yield of 26.6 bags per acre.

Twenty five cases of N.I.A.B. Suttons imported seed planted near the homestead, however, produced 186 bags on approximately 3 acres.

Soya Beans. 13.6 acres were included in the trials again. A very much better germination and stand was obtained with an increased yield.

Total yield=52 bags=3.9 b.p.a.

Arnold's G4 Cowpeas. 25 lb. of this seed was sown for bulking up and produced six bags of seed, which gave an average yield of 2.8 b.p.a.

Dr. Saunder's Cowpeas. 15 acres were planted to this variety very late in the season, and considering the date of planting, 23rd February, did very well, producing 78 bags of seed or an average yield of 5.2 b.p.a.

Arnold's 74 Velvet Beans. A bag of this variety was bulked up and planted with sunflowers for support produced 32 bags of seed; 30 bags were sent in to the Farmers' Co-op. Ltd. to be sold to farmers.

Pastures. The eight grass plots of improved pastures were divided in half and fenced on the arrival of the long awaited barbed wire. Water was laid on and four drinking troughs provided to serve all eight paddocks of 2½ acres each.

To commence with, the dairy herd was given free range over the unfenced portion. Their preference for the different pasture grasses being noted. Their selection in order of preference was as follows:—

1. Waterval (*Digitaria pentzii*).
2. Napier Fodder (*Pennesteum purpureum*).
3. Makarikari (*Panicum coloratum*).
4. Giant Rhodes (*Chloris gayana*).
5. Rhodesian Sudan (*Sorghum arundinaceum*).

The herd were next grazed firstly on veld grass and then placed on each of the grasses for 24 hours at a time with an interval of 48 hours on veld grazing before being placed on the next pasture. This was done to note the increase in milk yields if any.

Napier Fodder gave the most favourable results. Cows showing an increase in yield of from 2-4 lbs. per day. The Panicum Makarikari gave a slight increase in yield but not as much as the Napier Fodder. The remainder of the grasses showed little if any increase over veld grazing.

After December 31st all animals were removed from the half plots for hay to give the grasses a chance to come away.

The eight paddocks were then stocked with six young steers. The Panicum Makarikari and the Napier Fodder being stocked with seven each. The trial to run for 21 days and the physical condition noted. So as to ensure that the same steers were returned to the same paddock after each dipping the steers were paint numbered.

Only two paddocks were able to complete the trial, Napier Fodder and Panicum Makarikari. In these two paddocks the steers held their condition very well indeed, and the paddocks would have carried the animals for a longer period. The other grasses showed definite signs of over grazing and the animals declined in condition.

The plots for hay were cut on 24th March, the hay was cured on tripods, and when cured, baled and weighed. Each plot is $2\frac{1}{2}$ acres and the weights are given below.

1. Panicum Makarikari	5,922 lbs. hay =2,368.8 lbs. p.a.
2. Rhodesian Perennial Sudan	4,750 lbs. hay =1,900 lbs. p.a.
3. Giant Rhodes	4,950 lbs. hay =1,980 lbs. p.a.
4. Waterval	2,429 lbs. hay = 971 lbs. p.a.
5. Giant Rhodes plus compost plus fertiliser	7,453 lbs. hay =2,981 lbs. p.a.
6 Giant Rhodes sub-soiled plus fertiliser only	9,786 lbs. hay =3,794 lbs. p.a.

The Naivasha Star gave insufficient growth for it to be cut for hay.

The Napier Fodder was cut for ensilage and ensiled. When opened up it produced quite a good ensilage, a bit on the dry and coarse side compared with maize silage.

Agriculture in General. The Rifle Range which had been down to grass for a number of years was ploughed up and put down to green manure.

One hundred and thirty acres on the western boundary, south of the railway line, which had been down to grass for four years was also broken up and put down to green manure.

In all 725 acres were ploughed with a D2 tractor and three furrow disc plough. A very creditable performance for this small tractor but far too much to cope with with any degree of comfort.

Livestock. The dairy herd has done as well as ever. Ten heifers, the progeny of the original animals purchased for Gwebi came into milk and a further nine cows were purchased from the Union making the total of cows in milk to date 37.

The same method of wintering the dairy herd was employed with the same marked success recorded last year.

Fifty steers were purchased from De Beers Ranch to be fattened in 1948..

Twenty one steers left over from last year's feeders were penned up for fattening on 6th June. Their average liveweight on entering the pens was 1,059 lbs.

The steers were fed for 88 days and when weighted before departure their average liveweight was 1,244 lbs.

=an average increase per beast of 185 lbs.

=2.1 lbs. increase per day.

Twenty out of 21 steers graded Rhodesia's Best, one only failing to make the grade because he had eight teeth up to two weeks before slaughter.

Average c.d.w.=685 lbs., which means they dressed out 57%.

Average value per beast=£22 2s. 11d.

Pigs. These as usual have done well. 159 baconers were sent to the C.S.C., 13 more than the previous year, and netted £981 9s. 10d., which was £170 8s. 9d. more than in 1946.

Sheep. 34 wethers were sold to the butcher this year realising £81 8s. 4d. nett, an average of £2 7s. 10¾d. each .

The average c.d.w. of these 7-9 months old lambs was 33.8 lbs., dressing out 50%.

Summary of Livestock Earnings.

	£	s.	d.
Pigs ...	£981	9	10
Dairy ...	605	16	7
Steers ...	465	1	1
Sheep ...	81	8	4
Vealers ...	9	7	9
	£2,143	3	7

Building Operations. The Trainees' quarters were completed during the early part of the year and occupied.

An 8,000 gallon reservoir was constructed at the windmill north of the railway, together with a drinking trough in each paddock and now provides a more than adequate supply of water for the cattle in those two paddocks.

The piece of unfenced grazing north of the railway between the main avenue and Broadbalk East has been fenced and divided into two paddocks with a drinking trough in each, fed from the 10,000 gallon reservoir.

The long overdue sheep pens have at last been constructed with brick under asbestos cement roofing. The inconvenience formerly suffered in dosing and sorting has now become a pleasure.

The new dairy was constructed under contract and has been invaluable during the short courses in dairying which were held at Gwebi this year by the Dairy Division.

Compost. The making of compost is now routine farm practice, and some 1,400 to 1,600 cubic yards are made every year. Part of this is made at the cattle fattening pens at the homestead, and part at the kraal at the windmill paddocks. The quantity made on Gwebi Farm is only limited by the supply of the raw materials available, such as grass, maize stalks and other crop wastes.

Trainees. Ex-servicemen trainees have come and gone at irregular intervals after receiving instruction. The normal routine Short Course Students from Mount Hampdon also received instructions at Gwebi.

GOVERNMENT FARM, UMSHANDIGE.

Mr. C. G. ROCHER, Manager.

Climatic Conditions. The past season was one of the worst seasons that Southern Rhodesia has experienced. Very little rain fell from the beginning of January until middle of October.

Not only did little rain fall but the heat also was excessive and it affected the cattle as well as the crops grown under the Umshandige Irrigation Scheme.

The rainfall for the years 1947 and 1946 is as follows:—

January	1946.	1947.
February	Inches.	Inches.
March	10.33	2.80
April	3.99	1.17
May	.58	3.50
June	.55	nil
July	.20	nil
August	.12	0.40
September	nil	nil
October	nil	nil
November...	nil	nil
December	nil	0.20
Total	.49	5.20
	2.96	6.73
	19.22	20.00

The few inches of rain that fell in March were too late for the summer crops, but it did help the grazing a little.

Owing to the little rain we had and owing to the irrigation water being rationed no winter ploughing could be done, since the water available was not even enough to keep alive all the crops that were put in.

Water was rationed to all settlers as well as the Umshandige Government Farm, and it was only with very accurate calculation and management that some of the crops could be kept alive with the water allotted to each individual settler.

CROPS.

Maize. Although 120 acres were planted to maize the yield was very poor, only an average of 4 bags to the acre being reaped. The poor yield was the result of the terrible heat. The little irrigation water was just enough to keep the maize growing, but at the time of tasselling there was no humidity in the air to assist pollination with the result that 50% to 60% of cobs were blind or had set only a few mature grains.

Cowpeas. Only a small area of cowpeas was planted. The yield was only enough to make a little hay for the cattle, but this was very helpful in winter.

Oats. Approximately 35 acres were planted to oats. The varieties planted were S.E.S. and S.15. These oats were not reaped owing to the shortage of grazing available. The lambing

ewes and the dairy herd were kept going by feeding them on green oats. Both varieties grew well. The S.E.S. grew as high as 5 feet. These oats were cut down three times as green forage and then left to seed; but they seeded very poorly and as it was not worth reaping them, the cattle were put on to graze them down.

The oat forage proved a wonderful feed for milk production in winter time, and the cattle are very fond of it.

Oats will have to be one of the principal green forage crops for winter feeding here in the Umshandige Valley during the cold months when the lucerne must be rested.

Lucerne. The lucerne is doing very well in the valley. On the deep heavy black and red soils, and where phosphatic fertiliser was applied, the crop thrives well. During the cooler months of the year cuttings were slower at 4 to 5 weeks intervals.

The indigenous grasses have proved very troublesome weeds, especially after the third year. Lucerne that has been established 4 and 5 years ago is practically ousted by these grasses, but during this drought we had grazing for the cattle and sheep and the lucerne and grass mixture proved excellent. The little irrigation it was given helped to keep the grasses as well as the lucerne a wonderful pasture. The cattle did not bloat as may happen on pure lucerne pasture, and while the caterpillers were attacking the lucerne the grasses alone provided excellent pasture.

On one section of approximately 21 acres, 86 ewes with 67 lambs and 35 dairy cattle were kept from the end of June up to the end of October, and it was only irrigated every 3 weeks.

During this coming winter some of the older lucerne will be ploughed under and followed up with oats.

During June and July some 45 acres were sown to lucerne. The varieties sown were Hunter River and Chinese. All the seed was inoculated with the Lucerne Nodule Bacteria and it was sown following maize grown during the summer. An application of 400 lbs. of rock phosphate was spread on the ploughed lands and disced in before the seed was sown.

All seed germinated very well and kept growing slowly, but had a very yellowish sickly colour until the rains started in November. After this the lucerne got away and thereafter grew very well. Up to the end of December three cuttings were taken off. The first two were very poor as the lucerne caterpillar did a lot of damage to both cuttings, but the third cutting yielded very well.

Not only is the lucerne an excellent green forage for cows as well as all stock, but it definitely helps to improve the soil. It will be an excellent crop in the rotation programme on hand under irrigation here in the Umshandige Valley.

Lucerne Experimental Plots. As the new plots were made on a piece of very uneven ground the results in some trials were not so uniform as one would expect, because through levelling the ground a lot of top soil had to be removed from one plot

to fill up hollows in another plot. The result was that some plots were all top soil where other plots were only subsoil, and some had a mixture of both.

In the old trials, however, the results so far indicated differences in the rates of watering applied at different intervals as well as the best variety to grow in this Valley where it is so hot.

So far Chinese appears to be doing the best during the summer heat. It yields higher than either Provence or Hunter River, but its stems are a little on the coarse side.

As far as watering is concerned, it is found that by using half a cusec flow on 1/10th acre giving it 3 inches of water per cut and 3 inches 14 days later is the best during the cooler months, but as the temperature increases 3 inches every 14 days is more effective; three inch watering every seven days proved excessive as the lucerne then grows slower and the colour is sickly owing to waterlogging of the soil.

Further, it is found that if watering is done at longer intervals and even if a 6 inch watering is given every month the results are slower growth and very poor yields. This is also, no doubt, due to partial waterlogging of the soil.

Grasses. On 30.1.47 the following grasses were planted at the Government Farm to find out which varieties will do well here, especially for dairying:—1, *Stentaphrum secundatum*; 2, Purple Top Buffel Grass; 3, Dunn's Finger Grass; 4, *Setaria kasangula*; 5, *Setaria splendida*; 6, African Fox Tail; 7, *Paspalum notatum*; 8, Kasinga Canal; 9, *Acroceras macrum* (Nile Grass); 10, Kikuyu, 11, Napier Fodder; 12, Panicum Makarikari; 13, *Digitaria swazilandensis*; 14, Digitaria Waterval; 15, Star Grass No. 4; 16, Swamp Couch.

In the nursery the following proved valuable grasses:—Dunn's Finger Grass, *Setaria kazangula*, *Setaria splendida*, *Acroceras macrum*, Napier Fodder, Panicum Makarikari, Digitaria Waterval and *Digitaria swazilandensis*.

On 8th October some *Setaria splendida* and *Setaria kazangula*, and *Acroceras macrum* were planted out on the heavy clay soils, and at the end of December these grasses were grazed down twice by the cattle and are now 4 to 5 feet high and they were only irrigated twice. As all couch grasses will prove troublesome on lands under irrigation these have been destroyed.

Orchards. The fruit trees planted in 1943 have made vigorous growth. The apricots have done well. Apples started to bear and show promise.

The following varieties were planted:—10 apples, 13 peaches, 6 pears, 2 apricots, 3 figs, 2 plums. Also the following tropical fruits were planted and are all doing well:—10 guavas, 6 avocado pears, 25 bananas, some pawpaws as well as grenadillas.

The citrus orchard is coming on nicely and most trees are starting to bear. So far 183 trees of different citrus varieties are

alive and they are doing very well, especially the grape fruit and lemon trees.

Cattle. During the year most of the original cows in the herd were sold to the settlers, only 5 cows and 8 heifer calves were kept. Ten heifers were bought from Marandellas Grasslands Station and another 10 heifers were imported from the Union. The latter 10 have all calved, and some of these are giving up to 5 gallons of milk per day. The average yield for the 15 cows at present in milk is 38.6 lbs. per cow per day.

The cattle from the Union are doing very well, but they feel the heat.

During the year a big number of well-bred dairy cattle were bought by the Government for the settlers and are doing well.

Sheep. These have again done very well. During the year from 85 ewes, 86 lambs were born, of which 54 were cross breds, Black Head Persian ewes crossed with a cross bred Black Head Persian Dorset Horn ram.

The average live weight at 5 months for these lambs weighed on 18th December, was 62½ lbs.

Sixty-seven lambs were loaded at Fort Victoria on the 18th December and arrived at the Cold Storage Works in Salisbury on the 20th. The lambs were only killed on the 23rd. As a result of the delay in the trucking and slaughtering there was a considerable loss in weight. The average cold dressed weight of the lambs was 30 lbs. and the average nett price realised was £2 5s. 10½d., a highly satisfactory return.

The lambs were not fed any extra concentrates. They were regularly dosed with Government wireworm remedy and had mixed lucerne and grass pasture for grazing and every evening they were fed 4 lbs. of lucerne hay in the feeding racks.

Five of the pure bred Persian rams were kept, and two cross bred rams for sale to the settlers. Two lambs died of veld poisoning, two were destroyed because they were malformed and one lamb was born prematurely.

Diseases and Pests. Red Water and Heart Water are very prevalent diseases in the Valley, but as they are tick borne diseases it is hoped to get the Valley clean by frequent and regular dipping. Losses were not many. The Government Farm lost one heifer from Heart Water and one heifer from Red Water and Heart Water combined.

When the rains started veld poisoning was very bad, especially on the farms with the heavy clay soils where the tulip and other wild chingerinche is growing. Quite a few cattle were lost through veld poisoning.

Half of one month was spent on the settlers' farms helping to dose the cattle which became sick from veld poisoning.

In the orchards and lands Begrada Bug was troublesome on vegetables. Agrocide No. 3 was found an excellent insecticide.

The citrus trees were attacked by Red Scale; several sprayings had to be done with Alboleum. The fruit fly was very bad on the late peaches and the pumpkins, and hardly any pumpkins were reaped.

The lucerne caterpillar appeared very early this year and did much damage to the lucerne crops, especially on the new crops that were planted in June and July, but nature was helpful as hundreds of the white and black storks appeared and soon cleaned these caterpillars up.

General. Approximately 250,000 bricks were made on the Government Farm, of which most will be used in buildings on the farm.

A gang of 50 boys are kept on the farm and they are receiving a monthly average wage of £1 5s. 0d., plus their food and quarters. Native labour is still plentiful in the Valley and every farmer has enough labour to carry on operations.

During the year approximately 24,000 head of cattle went through the Government Farm dip tank, but it is hoped that in future this number will be reduced as some of the settlers are busy building their own dip tanks, which the Government is assisting with the necessary cement.

Ex-Service Trainees and Settlers. All the trainees, excepting three, who are newcomers, are now settled on their farms and are proving themselves. Some of them are doing very well for the short time they have been on their farms, and a few, in spite of the drought, had very good wheat and potato crops; also those that are going in for dairying are doing well, and it is hoped that it will not be long now before 1,000 gallons of milk will be delivered to the local cheese factory daily.

This Valley is excellent for dairying and every settler has the land to grow, most if not all, of the necessary feed for his dairy cattle, pigs and poultry, besides feed for the fattening of some steers, and for the feeding of fat lambs. The breeding of fat lambs is definitely a very paying proposition, if enough good feed is made available to give the young lambs a good start to grow out fast.

During the year the Land Settlement Board with a gang of 30 boys cleared enough land for every settler to make a good start, and at the moment a prisoners gang of 15 convicts are doing some more clearing of land for settlers.

GREAT "B" ESTATE.

Mr. G. L. BLACK, Manager.

A commencement was made during the year on the commercial production of hybrid maize seed, but owing to the great difficulties in obtaining European staff and quarters for them and in obtaining the requisite implements and native labour only moderate but useful progress has been made.

Most of the arable land protected by contour ridges was ploughed and planted to either hybrid maize or green manure crops to be ploughed under.

Approximately 40 acres of land, under irrigation, was planted to Inbreds for the making of Single Hybrids, and some 300 acres were planted to a Single Hybrid and certified open pollinated seed maize for the production of a Top Cross. The programme provided for the planting of 500 acres, but owing to the shortage of native labour and implements the balance of 200 acres was planted on Gwebi Farm.

It is anticipated that two thousand bags of hybrid top crossed seed will be reaped and made available to farmers for planting in the 1948-49 season.

The following is a summary of the work carried out by my Branch on the Estate during the year:—

Temporary compound built for 50 natives.

Sixty-three thousand bricks made and burned.

Two temporary dams across the river constructed

Fifty acres of irrigable land levelled for irrigation.

One hundred and fifty acres planted to green manure and ploughed under.

One hundred and twenty acres of land ploughed for the Tobacco Section.

Four major gullies filled in.

Two five-roomed cottages constructed for staff, and additions made to Mr. Black's quarters.

Water laid on to cottages.

Maize grinding plant installed.

Repairs to roads.

Turkish Tobacco Culture in Southern Rhodesia

By D. D. BROWN, Chief Tobacco Officer.

Climate. Turkish type tobacco is planted after the rainy season is well advanced and the soil has stored up sufficient moisture, consequently only moderate rainfall during the transplanting operations and period of early growth is necessary to bring the crop to maturity. The rains should normally cease one month after the tobacco is planted in the field. Local experience has proved that Turkish tobacco of excellent quality may be produced under a fairly well distributed rainfall amounting to no more than three or four inches after the crop is transplanted. The incidence of heavy rains when the plants are approaching maturity will result in the gum being washed off the leaf, thus causing the cured tobacco to be thin, papery and lacking body, flavour and aroma.

Turkish tobacco is sun-cured, and consequently it is essential that there be plenty of sunshine and little or no rain during the curing period. Should the tobacco on the curing racks become saturated with moisture through rain or heavy mist, the leaf will be discoloured and reduced in quality. The tobacco plant is susceptible to frost, and therefore requires an interval of at least two months between the last rainfall and the first frost in order to allow the leaf to ripen before harvesting.

Soils. Cultivation of Turkish tobacco in Southern Rhodesia is confined generally to sandy loam soils of granite or sandstone origin. "Contact" soils, which are found where granite and epi diorite, or dolorite, granite and banded ironstone, granite and schist, or sandstone and basalt are in contact, are also well suited to the crop. These soils vary in colour from white, grey, pink to light red, and are sometimes almost black where highly impregnated with organic matter. The surface soil is usually shallow, being from about four to eight inches in depth, but soils derived from sandstone are generally deeper.

Most of the sandy loam soils are somewhat lacking in plant food, but will produce fair yields of good quality leaf when properly managed. The "contact" soils are also classed as sandy loams, but are finer textured, more fertile and produce heavier yields of tobacco. This type of soil is seldom found in large continuous areas but rather in "pockets." It has proved highly suitable for the production of fine, silky-textured and full-bodied leaf.

The texture of the soil used greatly influences the yield and quality of the tobacco produced. Coarse textured sandy soils usually produce low yields of poor quality leaf. On such soils, however, an improvement in both yield and quality can be effected by the use of properly made compost and suitable applications of artificial fertiliser. Sandy soils of fine texture, in a proper state of fertility, produce high yields of uniform and full-bodied leaf.

The character of the sub-soil also has an important influence over the production and quality of tobacco grown on any type of land. If the sub-soil is impervious, the plants will, in certain seasons, suffer damage through the land becoming water-logged. On the other hand, should the sub-soil be too porous, the crop may suffer from drought in seasons of very light rainfall. Soil underlain by an excessively porous sub-soil will also not be retentive of artificial fertilisers. When grown on shallow soils with a stiff clay sub-soil, the tobacco tends to cure a dark colour. Tobacco growing is not recommended in localities where a bluish-coloured clay sub-soil is to be found. The plants are liable to suffer from "wet feet" when planted on land underlain by sub-soil of this type. The most suitable sub-soil underlying the granite sandy soils is reddish in colour, and contains sand, clay and gravel in the right proportions.

It has frequently been noted that some growers are averse to using land which requires fairly heavy stumping, when they can find land which needs little or no clearing preparatory to ploughing. That it pays to stump land may be laid down as a general axiom. The timber is useful fuel for general purposes; land which carries timber also contains more organic matter and is usually well drained. If untimbered land is selected, it is advisable to plant tobacco only on those sections which are naturally well drained. Low-lying fields and vleis which become water-logged during the rains are unsuitable for tobacco production. Care should be taken to select well sheltered fields with good natural drainage and which are free from early frost.

Generally the best quality tobacco is produced on virgin or second year land, and this applies particularly to sandy soils. This is attributable to the fact that in newly cleared land there is a plentiful supply of organic matter, which improves its mechanical condition and assists in the retention of moisture and plant food. The field should be of what is commonly called good live soil. A field in which the soil has become run down or worn out should not be selected for Turkish tobacco. The land should, therefore, be properly managed in order to maintain the physical condition and humus content of the soil as near its original state as possible.

Rotation of Crops. The proper management of the soil demands the adoption of some suitable system of crop rotation. When the same crop is grown continuously on the same field, it naturally follows that the soil is not cropped to the best advantage, and the incidence of plant diseases and insect pests is increased. Suitable rotation of crops is essential for the maintenance of yield and quality of tobacco and also for the prevention or control of root-knot nematode, *Heterodera marioni* (cornu.), Goodey, commonly known as tobacco eelworm in tobacco fields. Also the difference in the proportions of available plant nutrients assimilated and variation in the root system and in the effects produced in the soil by different crops, are beneficially utilised in properly balanced crop rotation.

Variations in climatic conditions and soil requirements make it impossible to devise a single rotation suitable for general adoption throughout the country. In deciding upon the inclusion of

any crop in rotation, it is necessary to consider the effect on soil fertility and the influence on following crops grown. Consideration must also be given to the number of cash crops, their market value, market demand and their suitability under local climatic conditions.

The influence of any crop as it effects the maintenance of soil fertility is, as a rule, fairly obvious; so, also, are the virtues of the respective crops in controlling the incidence of plant diseases and insect pests. The influence of other crops on the quality of the tobacco is not so easily discernible, however, and in the absence of reliable data, growers are advised to make their own observations and follow their own experience.

Experience has so far shown that Turkish tobacco should not follow immediately after a legume in a rotation, as too much nitrogen may be accumulated for the production of good quality bright-coloured leaf. The ever-increasing evidence of eelworm or nematode infestation in tobacco land has emphasised the need for the use of non-susceptible and resistant crops to be grown in rotation with tobacco. The use of chemicals to rid the soil of such pests as eelworm is still in the experimental stage and generally too costly except in the treatment of limited areas of valuable land such as seed-bed sites.

The question of the frequency of cash crops, soil improvement crops, market values and so forth can only be decided by the farmer himself, as he alone is fully conversant with the amount of capital available and the time and money which can best be spared in building up the fertility of the land and maintaining the quality and yield of tobacco.

The following rotations are suggested for the benefit of those who may be considering the introduction of crop rotations in their farming programme. Some modification may be required to render these proposed rotations more suitable for local conditions and requirements. The continuance of any rotation schemes giving satisfactory results in present use is recommended until such time as some more suitable rotations may be established.

1. Four-course rotation:—

   1st year.—Tobacco—virgin land in first instance.
   2nd year.—Tobacco.
   3rd year.—Legume—ploughed under.
   4th year.—Maize.
   Repeat.

2. Four-course rotation:—

   1st year.—Tobacco—virgin land in first instance.
   2nd year.—Tobacco.
   3rd year.—Legume—combination sunnhemp 30 lbs. and munga 12 lbs. per acre, composted and ploughed under with stubble.
   4th year.—Maize.
   Repeat.

3. Five-course rotations:—
   1st year.—Tobacco—virgin land in first instance.
   2nd year.—Tobacco.
   3rd year.—Maize.
   4th year.—Grass—for hay, or grazing.
   5th year.—Grass—for hay, stubble ploughed under.
   Repeat.

4. Five-course rotation:—
   1st year.—Tobacco—virgin land in first instance.
   2nd year.—Tobacco.
   3rd year.—Grass—for hay, or grazing.
   4th year.—Grass—for hay, or grazing.
   5th year.—Grass—for hay, stubble ploughed under.
   Repeat.

5. Five course rotation:—
   1st year.—Tobacco virgin land in first instance.
   2nd year.—Tobacco.
   3rd year.—Maize.
   4th year.—Legume—ploughed under.
   5th year.—Maize.
   Repeat.

6. Five-course rotation:—
   1st year.—Tobacco—virgin land in first instance.
   2nd year.—Tobacco.
   3rd year.—Cotton.
   4th year.—Legume—ploughed under.
   5th year.—Maize.
   Repeat.

7. Six-course rotation:
   1st year.—Tobacco—virgin land in first instance.
   2nd year.—Tobacco.
   3rd year.—Maize.
   4th year.—Legume for hay, stubble ploughed under.
   5th year.—Grass—for hay, or grazing.
   6th year.—Grass—for hay, stubble ploughed under.
   Repeat.

8. Six-course rotation:—
   1st year.—Tobacco—virgin land in first instance.
   2nd year.—Tobacco.
   3rd year.—Legume—for hay, stubble ploughed under.
   4th year.—Grass—for hay, or grazing.
   5th year.—Grass—for hay, or grazing.
   6th year.—Grass—for hay, stubble ploughed under.
   Repeat.

9. Six-course rotation:—
   1st year.—Tobacco—virgin land in first instance.
   2nd year.—Tobacco.
   3rd year.—Maize.
   4th year.—Grass—for hay, or grazing.
   5th year.—Grass—for hay, or grazing.
   6th year.—Grass—for hay, stubble ploughed under.
   Repeat.

10. Seven-course rotation:—
   1st year.—Tobacco—virgin land in first instance.
   2nd year.—Tobacco.
   3rd year.—Grass—for hay or grazing.
   4th year.—Grass—for hay, stubble ploughed under.
   5th year.—Tobacco.
   6th year.—Legume—ploughed under.
   7th year.—Maize.
   Repeat.

11. Seven-course rotation:—
   1st year.—Tobacco—virgin land in first instance.
   2nd year.—Tobacco.
   3rd year.—Maize.
   4th year.—Legume—for hay, stubble ploughed under.
   5th year.—Grass—for hay, or grazing.
   6th year.—Grass—for hay, or grazing.
   7th year.—Grass—for hay, stubble ploughed under
   Repeat.

12. Seven-course rotation.—
   1st year.—Tobacco.
   2nd year.—Tobacco.
   3rd year.—Cotton.
   4th year.—Legume—ploughed under.
   5th year.—Maize.
   6th year.—Grass—for hay, or grazing.
   7th year.—Grass—for hay, stubble ploughed under.
   Repeat.

In each of the above examples it is assumed that the rotation has commenced with virgin land being planted to tobacco. After completing the first cycle, it may be found desirable to grow only one crop of tobacco instead of the two stated. The same applies in the case of starting a rotation on old land in place of virgin land. This would then result in each rotation being shortened by one year during the second and subsequent cycles, unless, of course, an additional suitable crop is introduced in the place of the tobacco crop.

Owing to the serious incidence of tobacco nematode, it is advisable that the selection of legumes and other crops used in

rotation with tobacco should be restricted to plants resistant to eelworm attack.

The following is a short list of crops known to be resistant to nematode infestation and the seeds of which are available locally:—

Velvet Beans—varieties, Somerset, Jubilack 74, and Marbilee (red seeded).
Sunn hemp.
Groundnuts—varieties, Rhodesian Valencia (Spanish Bunch), and Virginia Bunch.
Wintersome.
Maize.
Munga.
Cotton—*variety, Gatooma, 9.L34.
Oats—varieties, S.E.S., Kherson, and Kinvarra.
Grasses—all species.

*Note. According to Jack a local strain of cotton, 9L34, is very highly resistant to nematode attack.

The pasture grasses, including Rhodes (*Chloris gayana*), Sabi grass (*Urochloa*), Buffel grass (*Panicum maximum*), Rhodesian Sudan (*Sorghum arundinaceum*), *Digitaria sp* including Milanje grass and Makarikari grass are recommended for a temporary grass ley. If an annual grass is required for conversion into hay or silage, the following may be grown:—Munga (*Pennisetum glaucum*, syn. *spicatum*), oats S.E.S., Kherson or Kinvarra only, rapoko (*Eleusine coracana*), sorghums, teff (*Eragrostis abyssinica*), annual Sudan (*Sorghum sudanese*), and "Crowsfoot" grass (*Dactyloctenium aegyptium*).

Detailed instructions concerning the establishment of improved pastures are published in the October, 1938, issue of the "Rhodesia Agricultural Journal" and reprinted as Bulletin No. 1084.

Amongst the plants commonly used in rotation with tobacco and stated to be hosts of tobacco root-knot nematode, are the following:—

Beans—kaffir (*Vigna catjang*) and garden.
Cotton—most varieties.
Cowpea—most varieties.
Potatoes.
Sunflower.

Dahl (*cajanus indicus*) syn.—Pigeon Pea and Nandora.

On a number of farms a system of tobacco production with grass fallow has been established with satisfactory results. After two successive Turkish tobacco crops the land is allowed to revert to natural veld and, after an interval of from five to ten years, the cycle is repeated by the land being again cultivated and planted to tobacco for two seasons. This system is practicable only where there are considerable areas of land suitable for tobacco and where climatic conditions favour the rapid establish-

* **R. W. Jack, F.E.S.: Report of Tobacco Research Board for 1944**

ment of the indigenous grasses, otherwise serious erosion of the soil may result.

A rotation containing no legume but including the small grain and grass crops which furnish a considerable supply of organic matter to the soil is generally considered to be most suitable for the production of good quality tobacco.

Seed-beds. The greatest care should be exercised in the selection of a suitable site and in the preparation and management of the seed-beds. A ready and plentiful supply of good strong, healthy plants when required for transplanting is almost a guarantee of a crop of tobacco, whilst a lack of suitable seedlings at the proper time is usually coincident with a crop failure.

Careful consideration should be given to the selection of a suitable site for the seed-beds. The area selected should, if possible, be well sheltered from the prevailing winds, for seed-beds placed in an exposed position not only require more watering, but the young plants do not thrive as they should. It is essential that the site should be near a permanent and uncontaminated water supply. The seed-beds should not be too close to large trees, as their roots would deprive the plants of food and moisture, and might interfere with the growth of the seedlings by casting too much shade.

A site having a good exposure to the sun is preferable, as this will influence the growth of the seedlings. The beds should be arranged so that the young plants may have the maximum amount of sunlight, the early morning sunlight being especially beneficial, therefore an eastern or north-eastern exposure is best.

In order to ensure the maximum supervision, the seed-beds should be as near as possible to the homestead. The proximity to the homestead will necessarily be governed by such considerations as suitability of soil, water supply and shelter. If possible, the beds should also be reasonably close to the fields. It may be necessary to erect an artificial wind-break constructed with long grass, reeds or maize stalks laced to a couple of strands of wire strained to posts surrounding the seed-bed area.

The area selected should not be located on a steep slope, but should be fairly level. When it is not possible to have a level site, the beds may be arranged in terraces on slightly sloping ground. In the latter case it will be necessary to dig a drain above the site to prevent any rush of water flowing down the slope and over the beds during rain storms. Adequate drainage should be provided for wherever there is a likelihood of damage being caused by a rush of water after heavy rain. The seed-beds should also not be too close to the banks of rivers liable to become flooded during the rains, otherwise irreparable loss of seedlings might result.

The most suitable soils for seed-beds are sandy loams and alluvial soils which have a plentiful supply of humus and are naturally well drained, fertile and friable. It may not always be possible to find an ideal type of soil on a suitable seed-bed site, and in this case much can be done to change the texture of the

soil to render it suitable. Should the soil be too light and friable, a few wagon loads of heavier soil or antheap can be spread over the surface of the site and thoroughly mixed with the soil. If the soil of the area is too heavy and stiff, an application of sand will improve the texture and make such soils better suited for raising tobacco seedlings. Care must be taken not to apply nematode-infested soil to the seed-bed site.

As Turkish type tobacco seedlings are grown during the wettest period of the year, the seed-beds should not be made in vleis which become water-logged in the rains. On many farms the soil near the only available water supply is inclined to be too wet. In such cases the only alternative is to provide adequate drainage. Time and money should not be stinted for this work, as the season's supply of seedlings may depend on the proper construction and efficiency of the drains. Generally speaking, open drains of sufficient width and depth to drain the site thoroughly should be cut around the four sides and, in addition, a channel must be cut from the lowest corners to lead away all drainage water. In order to prevent the sides of the drain from caving in, they should be made to slope inwards so that the top of the drain is wider than the bottom. The correct angle at which to cut the sides of the drains is determined according to the nature of the soil. For general purposes, however, the slope of the sides should be approximately 1 to 1 and not less than ½ to 1. For example, a drain 4 ft. deep and 2 ft. wide at the bottom would have a width of 10 ft. across the top on the basis of 1 to 1, and a width of 6 ft. on the basis of ½ to 1.

Negligence in the matter of drainage may be the cause of failure in the production of tobacco seedlings. Where artificial shelters are to be erected around the beds, space should be left for them between the trenches and the actual area of seed-beds.

An area should not be used for seed-beds more frequently than once in every four years. When the same area is used annually, the seedlings are more liable to attack by fungal and bacterial diseases and insect pests. The soil is also rendered less suitable through the heavy applications of water and the annual sterilising of the beds. New land is preferable for tobacco seed-beds, as weeds and grass are less troublesome, and the incidence of plant disease and insect pests is generally lower. Old vegetable garden sites should not be used for tobacco seed-beds because of the risk of eelworm infestation. Suitable crop rotation is essential in the case of an established site for seed-beds. The site should be sub-divided into four areas of equal size and separated by roadways about 15 feet in width. In any year only one of the sub-divisions should be used for tobacco seed-beds. This means that tobacco seedlings will be raised on each plot in rotation every fifth season. During the intervening years some suitable crop such as Giant Rhodes grass (*Chloris gayana*) should be grown for the purpose of soil improvement and prevention of soil erosion. Seed produced from these plots may be used establishing permanent pastures elsewhere on the farm.

In cases where the availability of suitable seed-bed sites happens to be strictly limited and makes it necessary to use the

same area every year, it is advisable to renew the soil occasionally by removing the old top-soil and replacing it with fresh.

Preparation of Seed-Beds. The preliminary preparation consists in clearing the site of undergrowth and rubbish and levelling the land. The area cleared should exceed that actually required for the beds, so that a margin of cleared ground shall surround the seed-beds. This work is best done during the winter months and some time in advance of the final preparation of the beds. The soil should receive an application of old well-rotted, pulverised farmyard manure or compost. The manure is applied broadcast at the rate of from 10 tons to 20 tons per acre some three months or so before the final preparation of the beds. The manure should next be thoroughly incorporated with the soil by ploughing or digging it in. After the application of manure, the soil should be worked at frequent intervals to assist further the decomposition of the manure and to destroy most of the weeds before the beds are seeded.

When compost is used in place of farmyard manure it is applied at the rate of from two to three petrol tins per ten square yards. Unlike farmyard manure, compost must be applied to the seed beds after they have been sterilised and the surplus ash and unburnt pieces of fuel have been removed from them.

In the final preparation, shortly before the date of seeding, the site is lined off into beds with pathways between. The beds may be made any convenient length, but the width should be restricted to three feet in order to facilitate drainage. Whenever possible, the pathways should not be made narrower than three feet; this width of path provides sufficient room for watering, weeding and removal of plants.

After the beds are measured and marked off, the top soil in the pathway strips should be thrown up on to the adjacent seed-bed; this operation when completed should leave the beds raised some nine inches above ground level. This will increase soil drainage and help to ward off fungal diseases such as "damping off" and "frogeye."

There are several methods of sterilising the soil, either by heat or chemicals, but the open fire method is generally practised in Southern Rhodesia and has continued to give satisfactory results. By this process weed and grass seeds are destroyed and insects hibernating in the soil are killed. First, a layer of dried grass should be placed on the beds and then, on top of the grass, a six-inch layer of maize cores or a 24-inch layer of brushwood. This quantity of fuel should be sufficient to effect thorough sterilisation of the soil to a depth of three inches or more. The burning is best done during the early morning or late evening, when it is generally calm. Tobacco stalks should not be used for sterilising seed-beds, as they may cause a fresh infection of disease; also, when tobacco stalks alone are burned, the ash contains an excess of potash, which may adversely affect germination.

When properly sterilised, the soil will have a light, dull red colour, and will be very friable and easily pulverised. A simple

test may be made by burying a potato about three inches below the surface in the seed-bed before burning, and when the potato has been cooked until the skin slips off easily, the soil has been properly sterilised. The beds should not be burned when the soil is either too wet or too dry; it should contain just sufficient moisture for cultural operations. After they are sterilised, the beds are allowed to cool before being enclosed with brick borders.

All unburnt portions of fuel and surplus ash should then be removed, leaving an even depth of about one-half inch of ash remaining on the beds. This ash is an excellent fertiliser, containing carbonate of potash, the best form in which potash salts can be applied to tobacco. However, if more ash is present, part should be scraped off until the above quantity only remains, otherwise there is a danger of the soil becoming too alkaline for proper plant growth. Next the compost should be applied and the beds dug over to a depth of approximately three inches, following which an application of tobacco seed-bed fertiliser is applied at the rate of two pounds per ten square yards and lightly raked in and the surface of the bed levelled off. The compost should be made according to the simplified process modified by Timson* to suit local conditions. The use of badly made compost is liable to have a deleterious effect on the young seedlings and may also introduce insect pests, disease and weed seeds to the beds. Compost made from tobacco crop residues, such as primed leaf, scrap and stalks, might harbour tobacco diseases and must, therefore, not be used as the seed beds may become contaminated.

There are a number of reliable proprietary tobacco seed-bed fertilisers which are recommended, but should the grower prefer to mix his own, an excellent mixture can be made up as follows:-

1 lb. superphosphate.
½ lb. nitrate of soda.
½ lb. sulphate of potash.

Mix thoroughly together and apply at the rate of 2 lbs. per 10 square yards.

After the beds are fertilised, finally levelled and in fine tilth, they are ready for seeding. The usual time for sowing Turkish tobacco seed-beds is from the beginning of December to the middle of January. The seedlings are then ready for transplanting from about mid-January to the end of February. In Matabeleland and other areas of the Colony where the distribution of rainfall is most erratic, the sowing of seed-beds should extend over a period commencing about mid-October and ending about mid-January. The seedlings in this case should be ready for transplanting from mid-December until the end of February.

On account of the small size of tobacco seed, there is a tendency, by growers who do not appreciate the number of seeds contained in a given measure, to sow the beds too thickly. There are approximately three hundred thousand seeds contained in one ounce and an ordinary teaspoon, level full, will hold about

*S. D. Timson, M.C.: "Kraal Compost," Rhodesia Agricultural Journal, May-June, 1942.

twenty-five thousand seeds. Before the seed is sown it should be properly cleaned in a tobacco seed separator which eliminates the light seeds and chaff. The seed may be sent to local firms who specialise in the cleaning and treating of tobacco seed.

For those who prefer to treat their own seed, the following is the method used:—Dissolve 17½ grains silver nitrate crystals in two pints clean, cold water. Soak the seed in this solution for fifteen minutes. Strain through a fine muslin bag and wash thoroughly in frequent changes of clean water until seed is free from traces of silver nitrate solution. The seed may then be sown wet or be dried for sowing later. When drying, the seed should be thinly spread on a sheet of paper or a cloth placed in the shade and not in the sunlight. Instead of silver nitrate, mercuric chloride or corrosive sublimate may be used at a strength of 1 in 1,000.

Yet another method may be used in the treatment of tobacco seed. In this case the seed is treated with a dry mercurial powder such as "Agrosan" used in the proportion of one part powder to twenty parts of tobacco seed by weight. The seed must be kept dry until it is sown.

When using properly graded seed, the following are the quantities normally applied:—

1 oz. of seed is sufficient to sow 240 square yards.

12 ordinary level teaspoonfuls of seed will suffice for 240 square yards.

1 ordinary level teaspoonful of seed is sufficient to sow 20 square yards of seed-bed area.

In order to distribute evenly such a small quantity of seed over the given area, it is necessary to mix the seed with wood ash, fertiliser or some other suitable medium. This should be light coloured so that it will indicate the evenness of distribution of the mixture when broadcast over the bed. When mixing with wood ash, the proportion is one teaspoonful of tobacco to about a quart or double handful of wood ash. Some growers prefer to put the requisite quantity of tobacco seed into a can of water and, after thorough stirring, apply the mixture of seed and water to the beds. Irrespective of the method of seeding, the beds should be thoroughly watered on the previous day in order to reduce the quantity of water required immediately after the beds are sown and to lessen the risk of the seed washing.

After sowing, a light dressing of clean sand should be applied. This serves not only to prevent washing, but the sharp grains of sand act as a deterrent to the small ants which carry away the germinating tobacco seed. The sand must be carefully applied, otherwise the seed will be covered too deeply. Immediately afterwards the beds should be watered with a can or sprinkler fitted with a fine spray.

During the early stages of growth of the plants especially, the seed-beds require to be kept constantly moist, but not wet. Normally the newly sown beds are watered in the mornings only and later on, when the seedlings are bigger, they are watered

morning and evening, while at a later stage an additional watering at midday may be required. Owing to varying conditions, it is impossible to state how many times a day watering is necessary, or the rate of application. A good rule, however, is to have the seed-beds always moist but not too wet. In the case of tobacco-seed-beds sown during the latter part of the season, less frequent watering may be found necessary because the requisite moisture is supplied by frequent showers of rain. When the plants have leaves slightly larger than a thumb-nail, a more coarsely perforated rose should be used on water cans. Later, for watering larger plants, the use of a rose may be dispensed with and replaced by a small square of tin clipped to the spout of the water can, and bent up in such a fashion as to cause the water to fall in a broad, flat spray. Watering must be done with cans, garden hose or sprinklers: irrigation or flooding are not recommended.

Water near the banks of a river, stream or pool is often infested with tobacco root-knot nematode (*Heterodera marioni*, cornu.) or tobacco eelworm. As a precautionary measure, therefore, water for seed-beds should be taken from mid-stream, preferably by means of a pump. Where cans or buckets are used, a reasonably wide and strong platform should be built out into the middle of the river or pool. Wet utensils should not come into contact with the ground at or near the water's edge, as soil particles adhering to the bottom of such utensils may carry nematode to the seed-beds.

Wherever possible, growers should make provision for a permanent supply of water from boreholes sunk close to the seed-bed site. This is recommended because water from such a source is free from infestation by tobacco eelworm. Further, the cultivation of land along river banks for seed-beds is liable to cause soil erosion and is contrary to the principles of conservation of natural resources.

Tobacco seed-beds should be sown in batches at weekly intervals, and each batch should be sufficient for approximately one-sixth of the total acreage to be planted during the season.

The total area of seed-beds required depends upon the intended acreage of tobacco to be grown. For each acre of Turkish type tobacco to be planted, a minimum of 100 square yards is required. In Matabeleland and other areas where the rainfall is most erratic, the seed-bed allowance per acre should be increased by about 50 per cent. in order to assure an adequate supply of seedlings.

Immediately after the bed is sown, combed grass is laid flat on the surface to hasten germination of the tobacco seed. Great care must be taken not to leave this grass on the beds after the seedlings appear—usually in about a week—otherwise the plants will grow spindly and die off. When this grass is removed some covering is necessary to protect the young seedlings from direct sunlight and the heat during the day and the cold at night. Either cheese-cloth, combed grass or sunn hemp stalks may be used for this purpose. In view of the fact that the beds are sown during the wettest period of the season, combed grass or sunn

hemp stalks are most commonly used for covering Turkish tobacco seed-beds. In this case a light framework of sticks and reeds is erected over each bed and set horizontally about twelve to fourteen inches above the surface. This is then covered with a thin layer of combed grass or sunn hemp stalks to exclude the strong sunlight. After about ten days, the grass covering is thinned out a little, and from then on the thinning process is continued at regular intervals until, when the plants are approximately five inches high, little or no covering remains. In the case of sunn hemp covers, these may be made in the form of mats which can be removed when the beds are to be watered or aired, or alternatively the stalks are placed singly across the frame and then are tied, leaving a space of roughly three eighths of an inch between each stalk. No thinning out is necessary, and this covering remains until the seedlings are ready for transplanting. After the seedlings are large enough for transplanting (roughly six inches high), they should receive only sufficient water to prevent excessive wilting. This will harden the plants preparatory to transplanting in the field. Tobacco seed-beds require constant care, otherwise the results may prove disastrous. If neglected, the seedlings may suffer a set-back or die through lack of moisture, or be destroyed by insect pests or plant disease. The beds should be kept well weeded.

Before removing seedlings for transplanting, the seed-bed should be well watered so that the plants can be easily removed without injury to themselves or the remaining plants. Immediately afterwards the bed should again be watered to firm the soil around the roots of the remaining seedlings in order that their growth may be retarded as little as possible.

The plants in the seed-beds may sometimes fail to make satisfactory growth: this may be caused by insect pests, disease or unfavourable soil conditions. If the soil is water-logged because it is badly drained then suitable drainage must be provided immediately. If due to the application of too much water, the rate of watering should be reduced and the soil aerated by light stirring. Excessive alkalinity of the soil will also adversely affect the growth of seedlings, and where this is suspected as the cause of retarded growth or dying off of seedlings, suitably selected samples of seed-bed soil and the water used for watering the beds should be sent to the Agricultural Laboratory for analysis and remedial recommendations by the Chemistry Branch. Seedlings do not make satisfactory growth when the beds are overcrowded; in this case thinning out is necessary.

Should insect pests or plant disease be prevalent, the grower is recommended to seek the advice of the Entomological and Mycological Branches of the Department of Agriculture.

Retarded growth may be due to lack of plant food, in which case the plants will usually have a sickly yellow appearance. This is especially noticeable when there is a deficiency of nitrogen. Nitrogen may be supplied by means of a solution of nitrate of soda or liquid fowl manure. The latter is to be preferred, as it is cheaper and more easily procured, besides also furnishing a more

complete plant food than sodium nitrate. The nitrate of soda solution is:—

1 lb. nitrate of soda,
8 gallons of water.

The above quantity is sufficient for approximately twenty square yards of seed-bed.

The liquid fowl manure is prepared in the following manner:—

Take a suitable receptacle and half fill it with fowl manure, then fill up with water. The receptacle should be allowed to stand in the shade for about five or six days, and its contents stirred at frequent intervals. After standing for this period the liquid should be strained ready for use. One gallon of liquid fowl manure should be diluted in eight gallons of water and then applied to ten square yards of seed-bed. After a few days a second application may be given.

The usual proprietary tobacco fertiliser mixtures can be used for stimulating the growth of backward plants, and is applied broadcast or in solution at the rate of one pound per ten square yards

None of the foregoing should be applied to young seedlings with leaves smaller than a threepenny piece.

Immediately after treatment the seed-bed should be watered to wash the solutions or fertiliser from the plants and so prevent the leaves from being scorched or burned. Also, when possible, application should be made on a dull, cloudy day or be deferred until late afternoon in order to reduce the risk of damage to the plants.

Preparation of the Land. For the proper development of the plants and the production of good quality tobacco, the plants should make rapid and continuous growth in the field. The soil should, therefore, be thoroughly prepared and brought into good tilth before the crop is planted. Virgin land should be stumped, cleared and ploughed during the preceding rainy season and allowed to lie fallow over the winter. A belt of trees should be left growing around the margin of the field to act as a windbreak. These shelter belts should be wide enough to leave room for a roadway running down the centre. The size of each field should not exceed fifteen acres. When clearing the land, all timber, including stumps and brushwood, should be removed from the field and not be piled or burnt on the land. Burning timber on the land is not only a waste of useful fuel but is also detrimental, as the heavy ash residues and the effect of the fire on the soil will cause the tobacco crop to grow unevenly. The newly cleared land should be ploughed—usually about March or April—while the grass and vegetation are still green and full of moisture, and before the soil becomes too dry and hard. After lying fallow during the winter months, the land should be ploughed and cross ploughed, and then harrowed with a heavy disc harrow, being finally smoothed and levelled by means of drag harrows. Land which has already been under cultivation should be ploughed immediately after the crop is harvested, so that a certain amount

of soil moisture may be conserved and to assist in the destruction of insect pests which may be hibernating in the soil. The field should be ploughed again during the early part of the following season and brought into good tilth just prior to planting.

The soil must not be worked when wet, since permanent injury might result. It is far better to allow the soil to dry for a few days.

In the case of all soils, whether virgin or previously cropped, it is imperative to secure a good tilth before planting. Whenever possible, the final ploughing and harrowing should be done after the soil has been moistened by the early rains, since any weeds germinating at this time will thus be destroyed and subsequent weeding and cultivation will be reduced to a minimum.

Suitably constructed stormwater drains and contour banks should be provided where necessary for the protection of land and crops. Around each field a strip of ground (say, twenty feet wide), kept free from weeds and grass, will assist in controlling insect pests. When the margins of the fields are straight and suitable pathways are made at convenient intervals across the field, much time and damage is saved during field operations.

Manurial Treatment. Until exhaustive experiments have been carried out with the manurial treatment of each type of soil used for Turkish tobacco culture, it will not be possible to make any categorical recommendations concerning the application of fertilisers. Owing to the diversity of the types of soil, their varying degrees of inherent fertility and lack of uniform treatment accorded in regard to tillage and cropping, it is only possible to deal with the manurial treatment of the crop in a general sense.

A big coarse growth is not desirable, therefore the application of fertilisers or manure is not recommended where the natural fertility of the soil is capable of producing a good crop of Turkish type tobacco. Detrimental effects are caused by too liberal an application of artificial fertiliser or manure, as in this instance it induces a coarse, rank growth of leaf which is generally late in ripening, difficult to cure and of poor quality.

To produce satisfactory results, the rate of application of fertilisers must be correct not only for each distinct type of soil, but should be adjusted to suit each individual field. In Southern Rhodesia it has been found that sandy soils of medium fertility require a dressing of some 175 lbs. of a complete fertiliser mixture having an analysis of nitrogen 3 per cent., phosphoric oxide 9 per cent., and potash 9 per cent. The fertiliser is applied broadcast preferably two or three weeks after the crop is transplanted This method is particularly desirable when the weather is excessively wet, in order to minimise the loss of fertiliser through leaching from the soil. If the land is to receive a dressing of compost this should be applied broadcast at the rate of approximately five tons per acre and harrowed into the soil about a week or ten days before the field is planted. In this case only half the usual weight of fertiliser applied to the tobacco will be required and may be broadcast along with the compost or else three weeks or a month later.

Transplanting. When the seedlings are about six inches in height they are ready for transplanting. Tobacco of desirable quality is rarely produced from unsuitable plants and the yield in most instances is disappointing. Seedlings which are less than four inches in height are sometimes used; these are too small and fail to make satisfactory growth unless the weather conditions are particularly suitable. A few hours of hot sunshine immediately after transplanting will either kill or seriously retard the growth of such small plants, while a heavy rainstorm may cause them to become buried in the soil.

On the other hand, overgrown, tough and woody seedlings are often planted in order to complete the intended acreage. This class of seedling, as a rule, does not make satisfactory growth; the flower head develops while the plant is still small and the leaves remain under-sized and do not ripen normally. Maximum results can hardly be expected unless the tobacco is transplanted during the most favourable period of the season.

The highest returns from Turkish type tobacco in Mashonaland are generally obtained from the crop which is transplanted during the latter half of January and the month of February. In Matabeleland the planting season should be from mid-December to the end of February.

Transplanting is best done on dull, misty days with frequent showers of rain, and every opportunity offering for transplanting the crop during such weather should be fully utilised. It is seldom, however, that the whole of the crop can be transplanted under these ideal conditions; the planting operations are governed by the incidence of rain, often in the form of local showers, and also to a great extent by the degree of moisture in the soil itself. It is inadvisable to transplant tobacco unless the soil contains sufficient moisture to prevent excessive wilting of the plants. Provided the soil is sufficiently moist, tobacco may be transplanted throughout the day, though the best time is the afternoon, as the plants are then subjected to less intense heat during transplanting. Irrigation may be employed for transplanting the crop in Matabeleland and other dry areas and may be used also to supplement rainfall during the growing season. The method of application is to draw shallow furrows at the requisite distance apart and to run the water into them to soak the ground. As soon as each furrow is sufficiently soaked in turn, the water is led into others and the seedlings are planted at the required spacing along one side of the furrow—not along the bottom of the furrow. As soon as the rows are planted the water should again be led into the furrow to set the soil around the plants. If dry weather prevails, a further application of water may be necessary in about a fortnight after planting. The furrows should then be closed and any subsequent irrigation should be applied through furrows drawn down the middle between the rows of tobacco. Alternatively, mechanical watering devices may be used instead of the conventional form of irrigation. Turkish type tobacco does not require very much moisture for its growth, and consequently irrigation must be applied sparingly and with discretion, otherwise the leaf will tend to grow large and coarse, subject to disease, and be of little or no commercial value.

When carting the plants from the seed beds to the field, they should not be exposed to the full rays of the sun, but should be protected by a hessian cover.

By the ordinary method of transplanting, the field is marked by shallow, parallel ridges preparatory to planting. If possible, the rows should be made to run east and west, so that the plants will receive the maximum amount of available sunlight. In this matter, however, the contour of the field will be the deciding factor. Ridges should be aligned diagonally across the slope of the field at an angle calculated to provide suitable drainage, and at the same time reduce the velocity of run-off during rain storms. This should minimise soil erosion and leaching of fertiliser. Alternatively, the field may be left unridged and the tobacco planted on the flat.

The seedlings are transplanted at the required intervals along the top of each ridge, or in the row when the field has not been ridged. The spacing normally employed for Turkish tobacco is from seven to nine inches between the plants and the rows are eighteen inches apart.

When planting on the flat, the common method of marking off the field and planting the tobacco is by the use of a long wire notched at from seven to nine inch spacing. The land is marked off every eighteen inches down one side and corresponding marks are made where the other end of the wire will reach when drawn taut. After the wire is in position, a tobacco seedling is planted opposite each notch, care being taken to keep all plants at the back of the wire. When the row is completed the wire is moved forward to the next peg, and the planting is continued until the end of the field is reached. By this method the marking and transplanting operations are carried on simultaneously. A small hoe, trowel or pointed stick is used for making suitable holes in which to plant the seedlings.

Yet another method is to make use of a marking frame and dibbler combined. The marking frame is made from straight sticks, about one and a half inches in diameter, and when constructed it resembles a small rustic gate. There are four uprights, the lower ends of which are sharpened to a point. These vertical members are spaced at intervals of eighteen inches and are held firmly in position by three horizontal members. The lower horizontal is fixed about twelve inches from the pointed ends, and the upper about three inches below the top of the vertical members. The third horizontal is placed across the middle of the vertical members. The marker may be operated by either one or two natives. The frame is held upright and pressed into the soil at intervals of seven to nine inches along the line of the planting wire. But this means the field is not only marked off, but suitable holes are also made to accommodate the plants. This combined operation of marking and dibbling is immediately followed by the transplanting of the tobacco.

The plant is carefully inserted until the root crown is about three inches below the surface, and then the soil is firmly pressed down around it. The tap root should on no account be bent up

when the seedling is being transplanted; plants with a bent root seldom make satisfactory growth. Also, the heart of the plant should not be placed beneath the surface of the soil. In order to test the work of the planters, an occasional plant should be grasped by the tips of the larger leaves, and, if properly set in the ground, the plant will remain undisturbed though the leaves may be severed by an upward pull.

Every endeavour should be made to secure an even and full stand of plants right from the time when the field is planted. An imperfect stand is for the most part due to unfavourable weather conditions, insect pests, plant disease, or bad workmanship. It should be borne in mind that a poor stand of plants seriously reduces the yield per acre. At the same time, plants growing around the margin of blank spaces in the field tend to produce leaf which is below the general average of the more closely spaced plants, thereby reducing the quality of the crop as a whole. Fresh plants should be transplanted to replace those which fail, and this should be done as soon as possible, because experience has shown that all necessary refilling is most effective when accomplished within the first fortnight after the field is planted. Any refills planted after this period are not likely to catch up with the rest of the crop, and consequently will be late in ripening. Many of the difficulties experienced during the harvesting and curing operations can be traced to uneven growth of the crop in the field. These can, therefore, be minimised by the adoption of approved methods and the exercise of due care at the outset.

Cultivation. Cultivation should commence soon after the plants have become established in the field. The first is done by hand hoes, and must be shallow to avoid injuring or disturbing the plants. When the tobacco begins to grow properly, a thorough and deeper cultivation should be given in order to stir and aerate the soil. On this occasion a single tine cultivator may be used. Subsequent cultivation should be done by hand hoes and be shallow enough to avoid damage to the roots. The soil should always be worked up towards the plants. No set rule can be made regarding how frequently the crop should be cultivated except that, after the second cultivation, the crop is best cultivated only as often as is found necessary to keep the field free from weeds. All cultivation should cease when the plants begin to flower. Cultivation after this stage will tend to delay maturity and cause dust to adhere to the leaf. The crop should not be cultivated while the soil contains a high percentage of moisture or when the tobacco is wet. Cultivation under such conditions is detrimental to the soil, which would become packed; the spread of disease is also liable to be more rapid and extensive and the spread of eelworm, if present in the soil, would also be greater. Over-cultivation is to be avoided, especially in the case of sandy soils, as stirring the soil hastens the losses of organic matter and adversely affects the natural structure of the soil.

Priming. The small leaves at the base of the plant should be removed and discarded about a month after transplanting the tobacco. One necessary precaution to be taken during priming

operations is the division of the labour gang into two sections —one to deal only with clean, healthy plants, and the other to follow after and attend to those plants affected by mosaic and other diseases which may be present at the time.

Turkish type tobacco does not require to be topped. It is unusual for suckers to make their appearance, but in seasons of heavy rainfall, particularly when the plants are reaching maturity, suckers are liable to develop. In this case the suckers should be removed without delay.

Seed Selection. An important factor in producing a satisfactory crop of tobacco is the use of good seed, which is true to type. As the quality of the seed will determine the quality of the following crop, it is essential that the selection of seed plants should be systematically carried on during the growing season from about eight weeks after the tobacco is transplanted. Careful observation will reveal outstanding plants in the field, and provided they owe their superiority to inherent qualities rather than to more favourable cultural or soil conditions, they should be chosen for seed plants. Having decided upon the ideal type of plant desired, only those plants which conform to this type should be selected as seed plants. The main points in the selection of seed plants include good uniform growth, number, size and shape of leaf, fine mid rib and small veins, early maturity and resistance to disease and pests. The final selection is made about the time the first flowers are beginning to open and just before harvesting commences. Before the flowers open, all shoots except four or five at the top should be removed and the seed head made ready for bagging. Any flowers which may have already opened should be removed before covering the seed head with a paper bag. The object of bagging the seed plants is to prevent cross-fertilising and to force self-pollination, thus transmitting the characteristics of the selected plant to the next generation. For this purpose a 12 lbs. to 14 lbs. light manila paper bag is placed over the seed head and tied securely but loosely to the stalk below the flowering branches. The bag should be pushed up on the stalk from time to time to accommodate the growth of the seed head. It is also advisable to remove the bags at fairly frequent intervals and examine the seed head for worms, which should be removed along with dead flowers before the bag is replaced.

The varieties of Turkish type tobacco grown in Southern Rhodesia are "Soulouk" and "Kavalla," the former being the more popular variety.

Harvesting. Turkish tobacco is harvested by the single leaf method, the leaves being picked as they ripen. Normally the crop will start to ripen approximately three months after transplanting. The lower leaves ripen first and the top leaves are the last to reach maturity. The first indication of ripeness is a change in the colour of the leaf, provided the change is not caused by conditions other than maturity of the plant. In seasons of severe drought or excessive rainfall the leaves will often turn yellow before the plant is fully ripe. Plants affected by disease will also change colour prematurely; nematode or eelworm is another cause of this condition. The leaves of plants thus affected generally fail to cure properly, and lack the necessary quality.

The dark green colour of healthy, light bodied leaf gradually changes to a greenish yellow as the tobacco reaches maturity. In the case of heavy-bodied leaf, the yellow may appear only in flecks or spots. The accumulation of starchy materials in the leaf causes it to become thick, brittle and the surface rough; this change from being pliable and smooth to the touch is another sign of ripeness. Such leaf will crack when folded and pressed between finger and thumb.

Generally speaking, the higher up the stalk the leaves are the more pronounced the change of colour, and the general signs of ripening must be before they are ready for harvesting. Furthermore, the heavier the leaf the riper it should be before picking. The number of leaves ready for harvesting varies according to the plant. Generally, however, from two to four leaves per plant reach maturity about the same time.

Successful curing of tobacco requires a combination of good judgment and careful workmanship. Much success in curing depends on harvesting the tobacco at the right time, when it is neither too ripe nor too green. Turkish tobacco should be harvested just before it becomes fully ripe. If harvested too green, the tobacco will cure out an undesirable greenish colour. On the other hand, over-ripe leaf will be thin, brittle, discoloured, and lacking in body when cured. The first picking is taken at the time the first flowers open, and subsequent pickings at weekly intervals. Harvesting is best done early in the morning, when the true colour of the leaf is more easily distinguished, and before the sun has caused the plants to wilt. If heavy dew has fallen overnight, picking should be delayed sufficiently to allow the leaf to dry. Tobacco should also not be picked too soon after a heavy shower of rain, in which case it is best to wait for a day or two before proceeding with thé harvesting.

During warm, bright weather, starch accumulates rapidly in the leaf, whereas during cold, wet and cloudy weather its formation is relatively slow. A high starch content in the leaf when harvested is associated with high quality and good colour and aroma when cured.

During each picking every effort should be made to harvest leaf which is uniform in ripeness, body, texture and size. This will lead to uniformity in the cured product and facilitate grading.

As soon as the tobacco is harvested it is carefully placed in small baskets or crates slung over the picker's shoulder. The leaf should be packed flat with the butts facing the same way, and the baskets should be fitted with hessian or other suitable covering to protect the tobacco from the sun. The baskets, when filled, are conveyed to the stringing shed or some shady spot close to the curing racks, where the leaves are threaded on strings.

Stringing. The leaf is roughly graded according to size and colour before stringing. All diseased, perished and damaged leaf is put aside and graded and strung separately. Stringing* is accomplished with the aid of a thin, flat steel needle, 24 to 27 inches in length. Suitable needles may be made on the farm from lengths of 10 or 12 gauge steel wire, hammered flat and

having one end filed to a point, a small hole being drilled through the other to take the string. The needle is passed through the mid-rib of each leaf separately and about half an inch from the butt. All leaves should face the same way, and only leaf of uniform grade and size should be strung together. When the needle has its full complement of leaves, the latter are carefully removed along on to the string and the needle is refilled with fresh leaf. This operation is repeated until the string is filled. Strings are usually cut to lengths of nine feet and will hold three 24-inch needles full of leaf. Approximately one hundred and thirty strings may be cut from a 16 ounce ball of twine and approximately nine hundred strings will be required to contain the leaf harvested from an acre.

As the strings are filled with their complement of tobacco they are carefully laid one on top of another, either full length or coiled in wreaths placed in a cool, shady place, pending their removal to the wilting room or the curing racks, as the case may be. The loaded strings should then be attached to laths, to wooden frames specially constructed for the purpose, or if the use of a wilting room is dispensed with, the strings may be tied directly to the curing racks.

Curing. The method commonly followed in Southern Rhodesia dispenses with the use of a wilting room, and such wilting as the leaf requires is accomplished by manipulation of the tobacco during the first few days on the racks. When filled with tobacco, the strings are suspended horizontally either on light, movable curing frames or on curing racks. The former may be constructed from bush poles, stripped of bark and cut into lengths of 9 feet and 4½ feet respectively. An open frame consisting of two side members, 9 feet long, and four cross bars, each 4½ feet in length, is nailed together so that the internal dimensions of the frame are approximately 8 feet by 4 feet, divided into three equal areas by the two centre cross-bars.

Each of these frames will accommodate from eight to ten strings which should be tied lengthwise in the frame and supported in the middle by the crass bars which keep the strings from sagging with the weight of the tobacco. The frames, when filled, are placed flat down on suitable supports or racks about two feet above ground level. The principal advantage claimed for the use of frames is that they can be removed and placed under cover during inclement weather. The same advantage is gained by the erection of a permanent roof under which the curing frames can be conveniently and rapidly moved at night and when rain threatens.

The majority of growers, however, prefer to use curing racks which consist of a series of parallel wires stretched over stout posts about 4 feet long, planted upright in the soil, leaving from 2 feet to 2½ feet standing above ground level. The posts should be carefully aligned and spaced at regular intervals of 8 feet one way and 4 feet in the opposite direction. The posts spaced at eight feet are best aligned to run north and south in order that the tobacco may receive the maximum exposure to the sun. The wires are drawn taut along the tops of these posts and anchored

at either end of the line, which may be made any convenient length. The width between the parallel wires should not exceed 4 feet. Across each pair of wires, straight sticks 4½ feet long are tied in pairs at intervals of 8 feet along the entire length of the rack, except that only one stick is required at either end. The tobacco is tied to these sticks so that the strings are parallel with the wires.

When hessian, canvas, waterproof paper or some other suitable material is used in place of grass for covering the tobacco on the racks, a single wire should be erected along the centre line between each pair or wires or rails and raised about 18 inches above them. This single wire should be firmly supported either by light posts spaced every 8 feet and in line with each pair of uprights forming the racks; or by a triangular frame fastened across the top of these uprights. By this means the covering is kept clear of the tobacco and better protection from rain is provided.

Light gum or bush poles may be used in place of wire horizontals if supplies of suitable wire happen to be unobtainable.

Not more than from eight to ten strings should be placed together, depending upon the size of the leaf. This is the maximum number of strings which can be accommodated without overcrowding and consequent damage to the tobacco. When tying eight strings across the 4-foot width, the spacing between each will be approximately 6 inches, and about 4½ inches in the case of ten strings. The outer strings should hang clear of the side wires or rails.

To keep the strings from sagging in the middle, one or two loose sticks, 4½ feet long, should be placed over the side wires or rails and under the strings to provide the necessary support.

Curing racks should be erected on a reasonably level piece of land, well sheltered from high winds and in close proximity to the storage sheds and conditioning pit. Approximately 400 feet of racks are required per acre of tobacco planted.

By the present method of curing, the wilting period is reduced to a minimum, and the drying process starts within the first day or two the tobacco is on the racks. This applies especially to ripe leaf harvested during the early part of the season. Later in the season the leaf does not colour so readily and it may, therefore, be necessary to keep the tobacco on the racks covered for a few days in order to yellow the leaf before it starts to dry. Great care should be taken not to over-wilt the tobacco through delay in uncovering, or by keeping the leaf packed too closely on the strings.

Normally, the strings of tobacco are tied on the racks during the late afternoon, and are then immediately covered over with a suitable covering such as hessian, waterproof paper, or canvas, etc., and, unless the tobacco is very much over-ripe, it is kept covered during the first day, then early on the following morning the covering is removed and the leaf opened out on the strings and exposed to the sunlight. The covers are replaced each night

and also when rain threatens or heavy mists occur during the day, otherwise the tobacco is liable to be damaged by the wet.

During the curing process the leaf gradually changes from a pale green to a greenish yellow. As the leaf dries out, the colour should change to a lemon yellow, which is the colour most desired in Turkish type tobacco. The rate of drying has an important effect on the result of curing. If the leaf is dried out too rapidly, it is killed prematurely and the curing ceases. On the other hand, if the rate of drying is too slow, the curing is prolonged. In either case the tobacco will be spoiled, firstly, by remaining green in colour and harsh and lifeless in texture, and secondly, by being "sponged" and lacking in quality. The initial colouring of the leaf occurs during the process of wilting which is accomplished by keeping the tobacco tightly packed on the string and under cover until the requisite greenish yellow colour is developed. The rate of drying is regulated by the opening up of the leaf on the string and exposure to the sun.

The length of time required to complete the curing depends upon the quality of the leaf and the climatic conditions. Thin, papery leaf will cure much more rapidly than full-bodied leaf. The curing will be accomplished in less time when the weather is warm and bright than during cool, cloudy weather.

Handling after Curing. The tobacco should remain on the curing racks until the web of the leaf and the mid-ribs are properly dried. Strings of tobacco which has cured a decided green colour should remain longer on the racks, in order to run some of the green out of the leaf. Another method of removing the green is to lay the string of tobacco out on the grass overnight and to leave it lying exposed to the sun during the day. The alternate wetting and drying of the leaf tends to remove most of the green colouring. Normally, the curing process is completed in from a fortnight to five weeks and then the cured leaf should be removed from the racks to make room for more tobacco. During the latter part of the season the leaf does not colour so rapidly, and consequently the curing time will be longer than for the earlier pickings.

The cured tobacco is best removed from the racks during the early hours of the morning, when the leaf is soft and pliable. It should not be removed later in the day, after the leaf has become too dry and brittle to handle without damage.

As the strings are brought in from the racks, they should be suspended from the roof of a shed or from the tiers of a tobacco barn. In the former instance, the strings are grouped together in the form of wreaths and suspended from hooks fixed close up under the roof (preferably an iron roof), or the strings are left hanging straight down. When tobacco barns are available, the Turkish tobacco may be hung up similarly in wreaths or strings, or else be suspended horizontally on sticks between the tiers.

Alternatively, the strings of cured tobacco may be stored in bulks, but as this requires considerable experience this method can only be recommended to experienced growers of Turkish type tobacco. When bulking tobacco, the leaf should be in suitable condition. The strings are extended to their full length and laid

out straight on a wooden floor or platform. Starting from the outside of the bulk, the strings are placed overlapping each other, the butts of the leaf facing outwards, until the centre is reached. Then the operation is continued from the opposite side, and this is repeated until the bulk is built up to the requisite height. The bulks may be made any convenient length and width but should not be made too large. They should be examined daily to make certain that the tobacco is not over-heating. If this should happen, the bulks must be broken down and the leaf aired before being rebulked, the inside strings being placed on the outside and the bottom strings being placed on the top of the new bulk. Generally bulks are broken down and rebuilt regularly once every fortnight. Bulking is seldom practised in Southern Rhodesia.

The tobacco is left hanging in the shed or barn until required for further handling and, before the strings can be taken down, the leaf must be conditioned by the introduction of moisture into the building. This is accomplished by placing a layer of grass to a depth of six to eight inches on the floor and keeping it thoroughly wet. Water may also be sprayed on the walls below the tobacco to increase the humidity of the air in the shed. All doors and ventilators should be kept open at night and shut during the day.

When the tobacco is in suitable condition, the strings are removed and sorted according to size and colour of the leaf preparatory to being baled. Any grass and much of the sand adhering to the tobacco should be removed by shaking the strings. It is essential that the tobacco contained in each bale should be of the same reaping and be uniform in body, size and colour. This will present no great difficulty if due care was taken in harvesting leaf uniform in body, size and maturity, and if the preliminary grading of the leaf before stringing has been efficiently performed.

Conditioning. Conditioning the tobacco for baling may be done by placing the strings in a conditioning pit until the leaf has absorbed sufficient moisture to bring it into the required condition. The most satisfactory type of conditioning pit is made by excavating a hole approximately 6 feet deep, 16 feet wide and 30 feet long. Inside this the pit is built in 9-inch brickwork and ordinary "dagga." The brick walls are built up against the sides of the hole, and any air spaces between must be filled up with loose earth, otherwise the efficiency of the pit will be impaired. The walls are carried up to a height of 4 feet above ground level, i.e., 10 feet above floor level. The end walls are built up in gables to a final height of approximately 16 feet. A doorway, 4 feet wide, is placed in the centre of one side wall, and steps are cut from ground level down to the floor of the pit. Ordinary bush timber, or gum poles, and grass are used for the roof and, if desired, a ceiling of poles, reeds and clay can be built level with the tops of the walls. A window is built above ground on either side of the doorway, and several windows are placed in the other side wall. The interior of the pit is divided lengthwise into compartments approximately 4 feet wide and 10 feet long, and constructed with bush poles or gum poles. The tiers should be spaced

about 18 inches apart, starting 2½ feet above floor level. A passage 4 feet wide extends down the entire length of the building on the door side, the tiers running at right angles to this passage. The tobacco is suspended from the tiers in the manner similar to hanging it in a tobacco barn.

When making use of the pit, care should be taken to remove the tobacco as soon as the leaf has absorbed enough moisture for baling. If left until it is in too high condition, the leaf will become discoloured and reduced in value. The correct condition for baling is when the web of the leaf is pliable but not soft, and the mid-rib breakable, but not brittle, for most of its length.

Baling. Turkish tobacco is baled on the farm in the ordinary press boxes used for baling Virginia type leaf. The dimensions of the completed bale are 34 inches long, 24 inches wide, and approximately 18 inches high. The weight of the bale should not exceed 100 lbs. On an average, approximately 120 strings of tobacco are packed in a standard weight bale. The strings are not cut, but should be folded into three, so that the final length is about 34 inches—the same length as the baling box. The leaf should not be pushed close together towards the middle of the string, but should remain separated as when drying on the curing racks.

When baling, the strings are placed lengthwise in the box with leaf straightened out, the butts facing outwards and the strings overlapping until the centre is reached. Then the packing is continued from the other side of the box, and this is repeated until the requisite weight of tobacco has been packed. A properly packed bale will, therefore, have the leaf butts showing on either side only and not on the top, bottom or ends of the bale.

No mechanical pressure should be applied when baling Turkish tobacco on the farm. The weight of the packer standing on a board placed on top of the tobacco in the box is sufficient to press the contents to the required density. The lid of the press should then be clamped down and the bale allowed to set for several hours before it is sewn up in hessian. The bale is then ready for storage pending despatch from the farm.

During storage on the farm, the bales should be frequently examined to see that the tobacco is in good keeping condition. Any bales found to be overheating through being packed in too high condition, should be opened immediately and aired until the tobacco cools down. When sufficiently aired, the bale is sewn up again and returned to the store room.

When a sufficient number of bales are ready, they are transported from the farm to a central warehouse, where the tobacco will be fully graded, blended, repacked and fermented ready for export. After delivery of all the bales of tobacco to the warehouse the responsibility of the grower ceases and is assumed by the warehouse management. This final manipulation of the tobacco requires considerable skill and experience and mechanical equipment which can only be economically employed by a commercial company or co-operative organisation formed by the tobacco growers themselves.

Improved Dryland Pastures

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INTRODUCTION.

The establishment of improved pastures in the Colony is the subject of a considerable number of enquiries at present and it is therefore felt that some information on the choice of grass, methods of propagation and time of planting, etc., may be of assistance to the farming community.

While the natural pastures (or veld) are the main source of feed of the cattle industry, they are, especially in certain areas, comparatively low in carrying capacity and the herbage produced is of poor quality during the greater part of the year. Experiments and trials are gradually building up a fund of information on methods of providing more productive swards—a question of the selection of species suited to the conditions and the right technique in establishment. It should be emphasised, however, that the establishment of pastures is less risky in the high rainfall areas, where they can be of more value also in providing better quality feed over a longer period of the year than the natural pasturage. In the drier parts not only is successful establishment more difficult, but the economic benefits to be derived from planted pastures are more doubtful.

The part which planted pastures, either temporary or permanent, may play in Rhodesian agriculture in the more favoured rainfall areas, may be summarised as follows:—

1. They can effect a considerable reduction in the amount of grazing land required. This is particularly valuable when dairy stock are being run, as it means that the amount of walking done per animal in search of grazing is cut down to a minimum. On the Grassland Experiment Station the grazing area has been reduced from 11 acres per beast to just about two acres per beast, by laying down Star Grass pastures.

2. The period of good grazing can be extended from approximately three months, which is the average for dairy stock on the sourveld, to perhaps six months or more. By the judicious use of established pastures, palatable grazing should

be available from November or December until the end of May.

3. Milk yields can be maintained on a high level for some six months off established pastures, as compared with about three off the natural sourveld.

4. More highly nutritious hay can be obtained off these pastures than from the natural veld, and the yields are appreciably higher, at least four times as much and very often considerably

The use of temporary (or ley) pastures as a means of increasing soil fertility is receiving attention in many parts of the world to-day, and wherever this question has been thoroughly investigated it has been found that a perennial grass cover is the most efficient producer of a granular soil structure (commonly called "crumb structure") so necessary for maximum crop yields. It has also been demonstrated that individual grasses differ in their ability to produce this crumb structure, and that the soils themselves may vary in their response to the influence exerted by the grass during the building up process, sandy soils being less responsive than loamy or clayey soils. This crumb structure is readily destroyed by cultivation, and from present information it appears that the full effect of a grass ley on soil structure is achieved in about two to three years in moist, and in about three to four years in dry temperate regions, and that the structure so formed is destroyed in about the same periods.

Under Southern Rhodesian conditions a great deal of investigational work still remains to be done before any reliable evaluation of ley pastures can be made, but the effects which such pastures may be expected to have on land which has been under cultivation for some years, may be summarised as follows:—

1. **Increased soil fertility (and thus crop yields) by improving the physical condition of the soil.**

2. **Improved permeability of the soil and increased powers to absorb large quantities of water quickly, thus lessening its tendency to erode or wash.**

3. **Reduction in the incidence of and losses caused by crop diseases, pest and weeds.** It should be recognised, however, that certain pests may be encouraged by a grass ley, e g., the wire-worm in European agriculture.

At the outset it should be stressed that exotic grasses, particularly those from temperate climates, have not as a rule proved

suitable to this country except under the most favourable circumstances of climate and soil fertility, and no recommendations regarding grasses of this type can therefore be made. The most promising species are undoubtedly those which are indigenous to parts of Africa and grow naturally under more tropical or sub-tropical conditions. They are hardy and more drought resistant in that they can withstand the long dry winters which very few exotics can do, and are generally better able to hold their own against invasion by inferior native grasses and weeds.

As the title of this bulletin indicates, only grasses suitable for dryland conditions will be described here. Grasses recommended for vlei pastures are discussed in another article. (Bulletin No. 1384, January-February, 1947. Preliminary results in improving the Sandveld Vleis on the Grassland Experimental Station, Marandellas, by J. M. Rattray and R. H. Fitt.)

METHODS OF ESTABLISHMENT.

Propagation. Unfortunately most of our better types of pasture grasses require to be propagated by roots. The only two species of which seed may be obtained commercially are Rhodes Grass and Rhodesian Sudan Grass, and even these are difficult to obtain. This lack of supply of commercial seed is due entirely to the fact that the grasses themselves, particularly runner-grasses, do not set much viable seed and a considerable amount of plant breeding and selection still requires to be done in this connection before commercial seed of these species are likely to become available.

The propagation of grasses by roots instead of seed usually acts as a deterrent on most farmers and all kinds of difficulties regarding the amount of labour and the time involved are raised when it is known that a certain type of pasture can only be established by roots. This should not be the case, as the process is a simple one and, unless the planting of other crops such as tobacco is in progress, the labour for this purpose can be used to advantage on rainy days when other outside work comes to a standstill. Again, if tobacco has to be planted out from seedlings there does not appear to be any valid reason why a perennial crop such as grass should be regarded so unfavourably because it has to be planted out in this way. This problem, however, is essentially one of espacement; if a satisfactory cover can be obtained by planting roots at, say, 6 feet by 6 feet apart, the labour required for establishment is not unreasonable and the cost appreciably less than where seed is used.

If the grass sends out surface runners which root at the joints, these runners may be cut up into pieces with one to three joints each, and planted in holes with a small piece of runner protruding above the surface. When underground runners are produced, these may be cut up and buried in the holes prepared for them. If no runners are formed, the crown is split up into a number of smaller plants and each of these is planted with its roots in the ground and the leaves above the surface. It is important not to bury these small plants completely otherwise they may merely rot away before striking. The soil should be thoroughly damp at the time of transplanting so that there is sufficient moisture present to carry the transplants several days in the event of no further rain falling.

Nursery Beds. In order to obtain a substantial quantity of planting material, if the pasture has to be established from roots, it is necessary first to develop a nursery bed of at least a quarter of an acre in size. The site for this bed should be on reasonably good soil which is kept well weeded, so that the grass can grow out quickly without hindrance and without being mixed up with various other grasses when it comes to transplanting it. The better and more cleanly the grass is allowed to grow in the nursery, the more will be available for planting out later. On Grasslands the majority of grasses are planted out 3 ft. x 3 ft., and in order to push growth as quickly as possible, the holes into which the roots are placed are first given a double handful of compost and then when new growth starts, a dressing of 200 lbs. per acre of phosphate plus a light dressing of sulphate of ammonia or nitrate of soda is applied. Three or four bags of roots will usually be sufficient to plant the nursery plot. It is an advantage to have the nursery so situated that the roots can be ploughed out for planting, as this will save labour.

Time of Planting. When transplanting any perennial plant it is always desirable to carry out this operation while root reserves are abundant. All plants of a perennial nature store up reserves in their roots during autumn for use in spring, and the first flush of leaves which appears at this time of the year is produced directly from these reserves. Green leaves commence manufacturing food as soon as they are exposed to sunlight, and this food is gradually sent down for the production of new roots and, of course, more new leaves. Hence by the time most of the reserve food material is used up, sufficient leaves and new roots are in operation to maintain a steady rate of growth. As the plants mature more and more food is directed into the production of flowers and seed, and at this stage of their life-cycle the process of building up reserves in the roots for the following

season is commenced again. This physiological process is important when it comes to transplanting, as it is obvious that plants with adequate food material still in reserve will not be affected by the uprooting and change from one locality to another to the same extent as those whose food reserves have already been used up and have to rely on new growth to ensure their establishment.

Perennial grasses are no exception to this rule, and the best time for transplanting them is when the first signs of new growth are visible. Sufficient food reserves are then still available to enable them to make rapid growth after transplanting. The more new leaves that are present and the nearer to maturity (i.e., flowering) that the grass becomes, the more difficult it is to transplant. At this stage transplanting is usually only sucessful if a large amount of earth is taken up with the roots so as to leave them virtually undisturbed. When irrigation or watering facilities of some sort are available, some grasses may be planted out as early as the end September or the beginning of October. However, if these facilities are not available, then it is, of course, necessary to wait until the rains have set in. This often means that the grass is in full flush by the time it is transplanted and that root reserves will be low, but if the weather is dull and the soil wet, and it appears that frequent showers are highly probable, transplanting may be carried out successfully until the end of December.

January is normally not a good month to plant roots, but at a later stage in the season after the grasses have flowered, and with the approach of autumn, as mentioned previously, the building up of reserves is started once more, and advantage may be taken of this fact to transplant in the months of February and March. The last rains of the season are then usually sufficient to ensure the production of a new root system which will carry the plants through the winter and allow them to come away quickly the following spring. Very successful plantings were made at Grasslands in March, 1947, when a silage crop of maize and velvet beans was under planted to Star Grass Practically every transplant struck and when the next rainy season commenced growth was so rapid that the pasture was ready to graze by the middle of November.

Planting by seed should only be carried out when the soil has been wetted to some depth and there is every likelihood of the rains having set in. Hot, drought spells, which often occur at the beginning of the rainy season, are dangerous when grass seeds have just germinated, and usually kill off a large number of seedlings. It is therefore always advisable not to plant early but to wait at least until the first week in December before sowing.

Preparation of Permanent Field. The term "permanent field" is used here to denote the area in which the grass is to be finally planted after transfer from the nursery. This area should be in good heart when planted to grass otherwise the results will be

A No. 2 Star Grass sward at Grasslands on granite sandy soil The field was planted at the end of December, 1947, and photographed in November, 1948. Note the dense cover.

A No. 2 Star Grass plant, which was underplanted in a silage crop of maize and velvet beans on a granite sandy soil at Grasslands, a month after the rains commenced the following season it had produced runners 6 to 8 feet long

Dairy cows grazing an improved pasture at Grasslands Experiment Station, Marandellas.

Waterfall Finger Grass. Planted 3 ft. × 3 ft. in a nursery plot at Grasslands at the end of December, 1947, and photographed in November, 1948. This grass usually takes two seasons to cover, but eventually produces a dense sward even on granite sandy soils.

Kazungula Timothy Grass at Matopos. A promising hay or ensilage grass in the better rainfall areas.

A good stand of a West Coast variety of Napier Fodder Grass at Matopos. Very heavy yields of fodder can be produced by this grass where soil and moisture conditions are favourable.

extremely disappointing. There is unfortunately too great a tendency on the part of many farmers to assume that once a land has been worked out and is in no further condition to produce a crop of any sort, it can quite easily be put down to some kind of grass without any further preparation. This is a completely erroneous idea and any such attempt is doomed to failure from the start. Grass must be treated as a crop in order to get the best out of it. Maize, wheat, oats and barley are all examples of high-producing annual grasses, and the soil must be properly prepared for them if a reasonably high yield is to be obtained. In the same way pasture and hay grasses must be regarded as high producing perennial crops if they are to produce economically. This fact often results in the argument being put forward that if a land has to be green cropped, manured and fertilised before grass can be planted, then it might just as well be put down to a crop of maize or silage. Admittedly the yield from such a crop will bring in a cash return which is no doubt very attractive and of immediate benefit, but this country is already learning what the effects of continuous cultivation can bring about, and there is little doubt that a periodic rest from ploughing is very necessary if soil fertility and structure are to be regained and, what is more, maintained. Lands which are allowed to lie fallow often take up to twelve years before they get back their original grass cover. This period of regeneration varies according to the condition in which the soil was left at the beginning of the fallow. The better the soil the quicker the natural cover comes back. However, this period of fallow is often an unproductive one and if the land can be so prepared as to produce a good high-yielding stand of grass quickly then it does not remain out of production for any length of time but can take its proper place in the economy of the farm almost immediately.

It is thus very necessary to prepare the permanent field in such a way as to procure a reasonably high standard of fertility before putting it down to grass. Unless compost or kraal manure is available, worked-out lands should be green manured the season before and then fertilised at the time of planting. On granite sands a dressing of 100 lbs. of rock phosphate plus 100 lbs. of superphosphate per acre should be applied before planting, and if possible a light dressing of a nitrogenous fertiliser should be given when the plants have taken. Ammonium nitrate at the rate of 50 lbs. per acre, or sulphate of ammonia or nitrate of soda at the rate of 100 lbs. per acre are the minimum dressings required and should prefrably be given at least twice during the season. If compost or kraal manure is used it should be ploughed in prior to planting.

Once the grass has been planted it is desirable to run the cultivators through the land once or twice, in order to keep it as free from weeds as possible so that running grasses can maintain contact with the soil and root themselves. The presence of a thick stand of weeds between the grass plants hinders this runner development and often results in the growth of spindly

plants which take longer to cover over. Cultivation has, of course, to stop when the runners grow out between the rows.

If the grass is to be sown from seed, then the permanent field should receive a good deal of attention before sowing. It is very necessary to work up a fine firm tilth before the seed is broadcast, firstly because the seed itself is usually fine and is difficult to cover over if the soil has not been broken down well, and secondly because the small grass seedlings are weak and not able to push their way out if large heavy clods are left on the surface. The land should also be as clean as possible, as heavy infestation of weeds and other grasses such as rapoko, interfere seriously with the establishment of the seedlings and patchy stands often result.

Fine seeds are broadcast more easily if they are first mixed with equal quantities of sand and superphosphate or bonemeal, and then just sufficiently damped so that the mixture disintegrates as it leaves the hand during sowing operations.

CHOICE OF VARIETY.

The choice of grass depends largely on climate and soil, but the following grasses have been successfully established as pastures in different parts of the Colony and are worthy of trial:—

Star Grass. Two of the most promising grasses for the granite sandveld areas of high rainfall are strains of East African Star Grass. These are commonly referred to as No. 2 and No. 4 varieties and were originally selected from among a number of other strains on account of their ability to withstand competition from indigenous grasses. The No. 2 variety is somewhat coarser than No. 4 and makes a good grazing sward, while No. 4 is finer and better suited to hay making as it cures out more quickly. No. 2 is earlier than No. 4, usually producing new growth a month before the rains, but both remain green and palatable until the first heavy frosts which may be as late as the end of June. Hay cut as late as May from both varieties proved of good quality with a protein content of 6 per cent. They are both susceptible to frost in so far as the leaves and runners are concerned, but the parent plants survive and new runners and leaves are quickly produced the following season.

The Star grasses are characterised by the extremely long runners they produce and the speed with which they cover the ground. These runners root at the joints or nodes, and it is this material which can be used for propagation purposes, as it is only necessary to cut them between the joints and to plant the rooted sections. If conditions for planting are ideal, those joints which have not yet produced roots may be planted as well. In order to ensure that a high percentage of the transplants will "take," a section of runner containing three or four joints should be cut and twisted into a loop and placed in the hole with a small piece protruding. This means that each hole then contains

three or four potential plants instead of one. In the nursery bed the plants should be spaced 3 ft. x 3 ft., but when transferring to the permanent field they may be planted out with a 6 ft. x 6 ft. spacing. This wide spacing allows easy cultivation until the runners themselves are sufficiently far advanced to prevent access by the cultivators. The No. 4 variety does not appear to be as hardy as the No. 2 strain as far as transplanting is concerned, particularly if it has been out of the ground for some time, and farmers are well advised to get this variety planted as quickly as possible with a minimum delay. This is especially the case if bags of roots have been ordered from one of the Experiment Stations and have been on the train for two or three days.

Rhodes Grass. This grass, which can be grown from seed, is suitable for the *warmer* parts of the Colony where the average annual rainfull is not *lower* than 25 inches. It can be established successfully on red soil or sandveld but demands a fairly high level of fertility. It should be sown at the rate of 8 to 10 lbs. per acre on land which has been prepared to produce a fine firm tilth. A sunn hemp crop may be grown first and cut as a hay crop or for compost, and the stubble disc-harrowed repeatedly to produce a suitable seed bed. It is important that the seed bed should have a fine tilth to ensure that the small seeds can be uniformly covered to a depth of about half an inch. With such a tilth the soil may wash with heavy rains and it is advisable to contour-ridge the land A method which is recommended to prevent excessive wash is to use a light sowing of sunn hemp (about 15 lbs. per acre) as a nurse crop. The sunn hemp should be cut for hay early to encourage the Rhodes Grass to cover the ground well before the end of the growing season.

Giant Rhodes Grass, which came from Tanganyika, is botanically similar to the ordinary Rhodes Grass and is merely a taller and more robust variety of this species. It should be sown in the same way and under the same conditions as the ordinary variety. Both these varieties of this grass send out runners and cover the ground quickly. Rhodes Grass is a particularly good hay grass but also can provide excellent grazing. It is best used as a temporary pasture of, say, three or four years duration.

For further details on the establishment of Rhodes Grass two "Rhodesia Agricultural Journal" Bulletins can be consulted, viz., No. 1084 of October, 1938 -"Improved Pastures," by S. D. Timson, and No. 1409 of July-August, 1947, "Giant Rhodes Grass Pastures at Trelawney," by J. M. Rattray.

Makarikari Panicum. This is essentially a grass for the fertile red soils which are situated in the warm areas with a medium to fair rainfall. It is one of the grasses which have to be planted out by roots and makes a very fine palatable pasture. It does not thrive on poor sandveld. It has been grown very successfully in the Hartley district, where one farmer has planted out a considerable acreage with the idea of working the grass into a

crop rotation as a ley pasture. He has developed a nursery strip method for providing planting material, which effects an appreciable saving in labour.

Briefly, these strips (six to eight yards in width and running the entire length or breadth of the field) are under planted in a maize crop with 6 foot rows. Two rows of Makarikari Grass are planted in each of the three or four maize rows occupying each of the strips to be planted, which are about 30 yards apart. Maize is planted the following year again, except of course in the strips put down to grass, and the planting of the field completed by underplanting the maize from roots obtained from the nursery strips. This reduces the transport problem to a minimum and ensures a minimum delay between digging out and replanting. The roots should be planted out at a maximum spacing of 3 ft. x 3 ft. With a closer spacing covering is quicker and usually more satisfactory.

It should be noted that there are two distinct strains of this grass. One is a spreading type which covers the ground entirely between the rows and gives a fine dense sward, while the other is practically upright and remains more tufted. The former appears more valuable both as a pasture and a hay grass. Where soil and climatic conditions are favourable, Makarikari Grass is very persistent, and owing to the expense of establishing is best planted for permanent pasture.

Waterfall Finger Grass. This finger grass has given excellent results on the granite sandveld areas of high rainfall under similar conditions to the Star Grasses. It appears to prefer the light acid sandy or contact soils and has not done well on the heavier more alkaline types.

It is slow growing and should be planted out with a spacing of 2 ft. x. 2 ft. When once established it forms a thick dense sward which provides excellent grazing but does not grow tall enough for hay. Besides being very palatable it is an early grass and often gives a green bite two or three weeks before the rains commence. It is a very useful pasture grass on the dairy farm for those small camps round the homestead, which are so essential for young stock, sick cows, bulls, etc.

Napier Fodder. On fertile red soils of the higher rainfall areas of the Colony, the broad-leaved "Gold Coast" and "Cameroons" strains of this grass do well but require special treatment to maintain their high yields over a period of years. Under optimum conditions this grass has a tremendous capacity

for growth and yields of 75 tons per acre and more of green fodder have been obtained in different parts of the world. Yields of over 30 tons per acre have been obtained in Rhodesia without irrigation. It cannot, however, be recommended for poor sandveld soils as growth under these conditions is usualy disappointing.

In the Union of South Africa, when the grass was planted in blocks, a spacing of 2 ft. x 2 ft. or 3 ft. x 3 ft. was not generally found to be as good as a wide spacing of 12 ft. between the rows with the plants about one foot apart in the rows. Close spacing appears to result in too much competition between the roots of adjacent plants, and as Napier is a vigorous feeder the soil is impoverished in the middle block and there is a pronounced marginal effect where all the plants are taller and more robust along the edges. A legume crop may be planted between such wide rows and reaped for hay or grazed; after cattle have finished the grazing, it is easy to plough in the manure which they have left behind. In other words, it is a question of maintenance of a high standard of fertility, and wide spacing facilitates this.

Napier Fodder gives good early grazing with a protein content as high as 12 per cent., but runs to stem if not cut sufficiently often. It is best used as a soiling crop or for ensilage and also can be a useful source of roughage for compost making. The local Rhodesian strain of Napier Fodder is known as Mfufu and is a much finer leaved variety than the "Gold Coast' or "Cameroons" varieties. It is not as leafy and does not produce the same bulk as the other two varieties, and for this reason is not so highly recommended as a fodder grass.

Creeping False Paspalum. This occurs naturally in many parts of the country both on the sandveld and on the red soil. It produces a dense soil cover which makes an ideal protective cover from the conservation point of view. On the sandveld it is inclined to remain rather short and flat, producing little top growth, but on the red soil it grows out to a height of 6 to 10 inches, or even higher under more favoured conditions, and makes a good grazing sward. It should be planted out fairly closely, not more than 2 ft. x. 2 ft. so as to obtain a complete cover quickly. The runners which it produces may be planted out as well as rooted sections of the parent crown.

Rhodesian Sudan Grass. This is a grass which has been successfully used in this country as a trap crop for witchweed in the maize belt areas. It is a strongly growing tufted perennial which thrives on red soil but does not favour the sandveld. As it can be grown from seed (sown at the rate of 20 to 25 lbs. per

acre) its establishment is comparatively easy, particularly as the seed is large and heavy and can be broadcast without difficulty. It produces a bulky hay or ensilage crop and can be cut twice in a season if necessary. As it is deep-rooted, useful grazing is provided early in the spring. Being a high yielding grass it requires fertile land to give the best results.

Milanji Finger Grass. One of the strains of this grass has done exceptionaly well on the sandveld in the Trelawney district. It is much leafier and more rapid-growing than the indigenous variety and covers the ground quickly even when planted 4 ft. x 4 ft. It forms a dense grazing sward and is at present being investigated as a ley pasture by the Tobacco Research Station at Trelawney and at Grasslands.

Kazungula Timothy. Although excellent results have been obtained with this grass in various parts of the Union of South Africa it has not been tried out extensively in this country yet. It would appear to like a fairly high rainfall if it is grown under dryland conditions, or a good rich black soil of a semi-vlei nature if grown under rainfall conditions between 25 to 35 inches annually. It can be grown either from seed or roots and also from the stems which will root at the joints if cut and covered over with soil. Several strains have been developed in the Union which are known by the numbers P1185, P1191, P1194, etc., and they vary tremendously in the amount of leaf and straw they produce. Yields of 5 to 7 tons of good quality hay per acre have been obtained from the more leafy varieties.

In order to obtain high yields the land should be well composted or fertilised before planting or sowing. The seed is fine and requires a good tilth if it is to establish itself successfully. Roots may be planted eighteen inches apart in rows which are 3 to 3½ feet apart.

Kikuyu Grass. Apart from certain areas in the Eastern Districts, where the soil is good and the rainfall high, and a few other specially favoured localities of rich deep moist soil, Kikuyu Grass does not do well in most of Rhodesia as a pasture grass. It has been found useful for growing on dam walls as a soil-binder, but on the whole moisture and fertility conditions are unfavourable for it and it does not thrive. On granite vleis the first year it usually appears quite promising, but unless a high degree of fertility is maintained, it soon becomes stunted and short and produces little top-growth. On the more fertile vlei lands it does well providing the soil remains reasonably moist during the dry season. And in the high rainfall Eastern Border areas at the higher altitudes it is one of the most successful grasses so far grown.

Kikuyu Grass can only be grown from roots or runners, which should be planted with a spacing of not more than 2 ft. x 2 ft. apart. A simple method of planting is dropping the planting material in the furrow behind the plough as complete covering to a depth of three or four inches is an advantage.

African Foxtail and Molasses Grass. These grasses have shown a certain amount of promise in trials on the sandveld and because they produce a good quantity of viable seed investigations are continuing. African Foxtail can stand fairly dry conditions and, indeed, is indigenous in the lowveld of this country, and if grown on fertile soil, produces a fine even hay crop. Molasses grass makes a good dense cover which remains green until quite late in the season.

Urochloa Grasses. These are indigenous to Rhodesia, occurring in many of the red soil areas and in the lowveld and afford early spring grazing and good hay. They produce a fair amount of seed which is mostly viable and will establish under the right conditions. The Urochloas are more suited to soils with a higher level of fertility than the granite sandveld and would appear to favour a fairly warm climate.

CONCLUSION.

In this bulletin the question of the establishment of pastures under dryland conditions in the Colony has been discussed briefly, and short descriptions have been given of the grass varieties which have so far proved the most promising of the numerous species under trial. No mention has been made of pasture legumes, as none have been found which can be recommended with confidence (excepting, of course, lucerne under irrigation). An intensive search for suitable pasture legumes is being continued, however, as it is realised that if successful, the possibilities of improving the quality and productiveness of our pastures would be increased enormously.

Laboratory Diagnosis of Disease

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(This is a reprint of Bulletin 1191, now out of print.)

PART I. PREPARATION OF SMEARS.

Accurate diagnosis is of the utmost importance in the control of disease. On it depends treatment and prevention.

There are many ways in which a disease can be recognised and differentiated from other diseases—herein lies the art of veterinary science—but there is none so complete or comprehensive as laboratory diagnosis, particularly in those cases where, by laboratory aids, the actual cause of the disease can be demonstrated.

Of the various methods employed in a laboratory to identify diseases "smear" diagnosis takes pride of place in this country, where so many of our more important destructive diseases are caused by organisms which can be demonstrated and differentiated with the aid of the microscope. Redwater, gallsickness, East Coast fever, anthrax, quarter evil, and trypanosomiasis (tsetse fly disease) provide examples of these.

For diagnosis to be made by this means, however, it is essential that the smears be properly prepared, and although most stock owners have repeatedly received instruction in smear preparation it is still all too obvious that many of them continue to submit so-called smears which are utterly useless for examination, due entirely to faulty preparation. Others again, and these represent the vast majority, submit smears which, while being just capable of examination, are so poorly prepared as to render diagnosis extremely difficult and in some cases even uncertain.

Smears may be prepared from various body fluids or tissues, e.g., blood, lymph gland, spleen, oedematous fluids of quarter evil lesions, pus, etc., and from either the living or the dead animal. The final object of preparation in each case is to secure a clean, uniformly thin film of the material, and the material only, no foreign matter such as dust or dirt being included, on a clean, clear, flat, glass slide.

PREPARATION OF SMEARS FROM THE LIVING ANIMAL.

Blood. For this purpose special smear glasses are issued free of charge by the Department. As shown in the diagram these glasses are rectangular in shape, measuring 3 inches long, 1 inch wide, and 1-2 m.m. thick. The first essential to success is scrupulous cleanliness. When the correct glass slide is not available, a serviceable substitute can be prepared by cutting or even breaking a flat, clear, unscratched piece of a thin window pane. Flatness is essential and so-called smears that have from time to time been received on pieces of bottles have naturally proved

utterly useless. If the surface of the glass is in any way dirty or greasy it is impossible to take a good smear.

When lifting smear glasses grasp them by the edge, since the hand is slightly oily and, if the surface is touched. this will prevent the blood spreading evenly or taking the stain properly. Having lifted a smear glass correctly, polish the surface with a *clean* cloth, e.g., handkerchief, then stand it up on its end on a clean piece of paper out of the way of dust while another glass is similarly polished. It is generally advisable to polish three or four glasses so that in the event of the first smear not being a success, other glasses may be lifted quickly and correctly before the oozing blood has a chance to clot. The next part of the procedure is to clean the edge of the ear at the site of the proposed incision. The assistance of a second person will be required to hold the head of the animal. The margin of the ear about 2 inches from the tip is the best site at which to make the incision. Remove all the hair for a distance of 1—2 inches along it with a pair of scissors, then rub the hairless edge with a clean duster to remove any bits of scurf and cut hairs. With the point of the scissors make a small incision about $\frac{1}{8}$ inch deep into the edge of the ear. A razor blade or very sharp knife can also be used for this purpose, but scissors are preferable. Generally this will be sufficiently deep to cause a small drop of blood to exude; if not, the cut may be flicked with the finger until the blood begins to appear. It is important not to make the incision too deep, firstly, because the first drop of blood to exude is usually richer in parasites than subsequent ones, and secondly, because if the blood runs out freely it is difficult to avoid getting too much on the slide.

The actual technique of smearing the blood is simple, but requires a little practice. A polished smear glass is quickly but correctly lifted with the right hand and placed between the base of the thumb and tips of the fingers of the left hand as illustrated. A second smear glass is then lifted with the right hand and a small drop of the oozing blood—about the size of a millet seed - is collected on its under surface at the extreme end. No time should be wasted between the appearance of the blood in the incision and its transfer to the slide—delay will permit of clotting occurring and a good smear cannot be made from clotted blood. It is also futile to prepare a smear from the clear watery fluid (serum) which might be the first to exude from the incision, if bleeding does not occur properly. Having collected the drop by merely touching the exuding blood with the slide, the second slide is then applied to the first near one end to form an angle of about 30 degrees, with the drop of blood in the acute angle between the two slides (see diagram). As soon as this is done the blood will spread laterally between the surface of the first slide and the edge of the second. If the second slide is now pushed along the surface of the first towards the thumb a thin film will be left. The pushing should be done at a uniform and fairly rapid rate and at a constant light pressure.

In a good smear the film does not reach the end of the slide —the blood tailing off about half to three-quarters of the way along the surface of the slide (see diagram).

The mistake most frequently made is to take too much blood—as stated, a drop the size of a millet or munga seed is quite sufficient. An ordinary drop is about 5 to 6 times too much. If it is realised that too much blood has been collected on the slide edge, the slide should be immediately flicked to remove the excess. Having made the film, let it dry completely—a good film dries in 4 to 5 seconds. In damp, dull weather drying may tend to be slower and should be hastened by briskly waving the smear. When dry, wrap it up in a piece of clean, non-dusty paper. In no circumstances whatsoever should another slide be stuck on top of the film.

Gland. Gland smears are of importance in the diagnosis of East Coast fever, but since their preparation requires a certain knowledge of anatomy, the stock-owner need only rarely concern himself with these. Either the prescapular, pecrural or parotid gland may be used; the prescapular, however, is generally the the one of choice. This gland is located in front of and a little above the shoulder joint. In spite of the fact that it is covered by a muscle, it is possible to palpate it in the healthy animal. In an animal suffering from East Coast fever the gland is much enlarged, but though readily palpable, it is often extremely difficult to immobilise while a needle is inserted.

The only apparatus required is a large hypodermic needle measuring 2½ to 3 inches long and smear glasses.

The animal should be securely held by the head, preferably in a crush pen or against a wall, to prevent its moving away from the operator. Very large, powerful or fractious animals may have to be cast for the operation. When dealing with the right side of the animal the gland is grasped with the left hand, while the needle is inserted with the right. In the case of small animals it is possible to hold the gland sufficiently firmly with just the left hand; in larger beasts, however, it will often be found more expedient for somebody to immobilise the gland with with both hands while the operator inserts the needle.

When holding the gland endeavour to force it superficially by placing the fingers and thumb behind it. The needle is pushed through the skin and covering muscle into the underlying gland. The fact that the gland has been pierced will be recognised by a "gritty" sensation. The needle is slightly withdrawn and reinserted into the gland two or three times. After the final insertion apply a finger firmly to the exposed base of the needle and withdraw it. The needle will be found to contain two or three drops of gland substance which are then blown on to a clean slide and smeared into a thin film. As an alternative to placing the finger over the base of the needle before withdrawing it, a syringe may be attached and used to suck up a little of the gland fluid. The former method, however, is preferable. Gland fluid is not nearly so rich in cells as is blood and a thicker film requires to be prepared than in the case of a blood smear.

As with blood smears the gland smear should be allowed to dry completely before it is wrapped in a clean, non-dusty piece of paper.

THE PREPARATION OF SMEARS FROM THE DEAD ANIMAL.

Owing to the rapidity with which putrefaction takes place smears should be prepared as soon as possible after death. Even a few hours in hot weather allows the normal bacteria in a carcase to produce liquefaction of the various body cells in which the disease producing organisms are to be found, thereby interfering with diagnosis. This is especially true in the case of a soft internal organ such as the spleen.

Blood. The essentials in this connection are *identical* with those described in the preparation of blood smears from the living animal. It is even more important here, however, that peripheral blood from the finer surface capillaries be used.

Putrefaction occurs most rapidly in the interior of a carcase and the organisms responsible for it only extend to the superficial parts later, hence blood from the deeper vessels is decomposed at a far earlier stage than that in the thinner extremities such as the ear or the tail. When more than a few hours have elapsed since the death of the animal, blood should be obtained for smear preparation by cutting into the ear or the tail. In other cases satisfactory blood can usually be obtained from the fine vessels severed during the skinning of an animal— in these cases it will be seen welling up as small drops in the subcutaneous tissues. On no account prepare smears from blood pouring out from large blood vessels or from the heart—it will not be nearly as well preserved as the other. Good smears cannot be prepared either from clotted blood or from serum, but the former, if necessary, can be broken down between the slides and then smeared out and prove serviceable for examination, whereas the latter is never of any use.

If there is any suspicion that a beast has died of anthrax the carcase should on no account be opened; all that is required for diagnosis is a blood smear, and this should be made without cutting into any part other than the ear or tail.

Spleen. Spleen smears are of special significance in the diagnosis of East Coast fever. When forwarding smears from any dead animal a spleen smear should always be included, except, as mentioned above, where there is reason to suspect anthrax. The actual technique of making a spleen smear differs slightly from that employed in the making of blood smears.

A deep incision should be made into the substance of the spleen with a knife. A little spleen pulp is then collected on the end of a smear glass by scraping the glass along the cut surface. This is applied to the surface of a second smear glass, as described in the preparation of blood smears, but this time the glass upon which the smear is to be made should be held at one end between the finger and thumb of the left hand. The smear is then made by drawing the first smear glass along the surface of the second, with the spleen pulp in the angle between the two glasses. It will be noted that in the case of blood smears the glass used for making the smear is pushed towards the thumb of the left hand, while in the case of spleen smears the direction

is reversed, the action being a drawing instead of a pushing one. As in the case of blood smears the usual tendency is to make the smears too thick. If the smear does not appear to be quite right it is preferable to make another one, rather than to attempt to alter the first by again drawing the glass across its surface.

Muscle, Gland, Pus, etc. The procedure in preparing muscle, gland and pus smears is similar to that described under spleen smears. Muscle smears should always be submitted when it is suspected that quarter evil was the cause of death. The smear should be taken from the actual lesion. In practically all cases this is easily found as a crepitating swelling in some muscular part of the body such as the shoulder or hind quarter. On cutting into this there is seen a large amount of blood-stained, dirty-red or claret-coloured slightly frothy fluid under the skin. Towards the centre of the lesion the tissue is dry, black or blackish-red and the muscle fibres are dissected by gas formation. Such muscle cuts with a sound like cutting inflated lung, and has a strong odour of rancid butter.

Before assuming that gassy swollen quarters are the result of quarter evil one should obtain a general impression of the state of preservation of the carcase—any carcase in which decomposition is advanced tends to swell and get gassy. In quarter evil, even although the rest of the carcase is perfectly well preserved, the characteristic gassy swelling is present.

Gland smears are prepared in the same way as spleen smears, the pulp being obtained by scraping the cut-surface of the gland selected, usually one of the large and fairly superficial glands.

Similarly, pus smears can be made from the pus contained in any abscessed organ.

POINTS TO REMEMBER.

The following points deserve special emphasis:—

1. Diagosis of a disease is never more certain than when based on smear examination. Treatment and prevention depend on accurate diagnosis, therefore in cases of sickness or death submit smears.

2. Smear preparation requires considerable care, especially in regard to cleanliness and thorough drying of the film.

3. In the case of sick animals blood smears only are required unless East Coast fever is suspected when gland smears as well are essential.

4. Preparations from dead animals should be taken as soon after death as possible. Always submit blood and spleen smears unless anthrax is suspected, when, as the carcase must not be opened, only blood smears can be prepared. For the definite diagnosis of quarter-evil, muscle-lesion smears are required in addition to blood and spleen smears.

5. Always give the following particulars: Name and address of owner, nature of preparation, kind of animal, ante- and post-mortem history, disease suspected.

(To be continued.)

Tick Transmission of Disease

By D. A. LAWRENCE, B.V.Sc., Director of Veterinary Research.

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Ticks may be harmful to an animal merely as a direct result of the amount of blood they remove in feeding, the irritation they cause, and the injury they inflict on the skin, thus interfering with its normal functions and furnishing openings for the invasion of organisms, such as bacteria or fly larvae (screw worms), that normally cannot invade the intact healthy skin. These harmful effects of tick-infestation may in themselves be very serious, but even far more serious is the fact that ticks transmit deadly diseases. It is the latter aspect that is of prime importance to the veterinarian and the cattle-owner.

Transmission of Disease. Ticks do not directly cause disease - they transmit the infection and therefore must themselves first acquire such infection before being capable of transmitting it to an animal. One may thus have ticks of a species known to be the transmitter of a particular disease not themselves carrying infection and therefore capable of feeding on an animal without producing disease in it: for example, the Bont tick is the proved transmitter of Heart Water, but every Bont tick has not acquired a Heart Water infection, i.e., it is not infective and therefore only those Bont ticks which have become infected are capable of setting up the disease, the others may feed on a beast without causing anything more than the directly harmful results first mentioned.

How do Ticks become Infective? Some knowledge of the life cycle of ticks is essential before the answer to this question can be appreciated. For the purpose of this note only ticks of the family *Ixodidae* will be considered, as the members of the *Argasidae* family are intermittent feeders and are generally not important except in the transmission of the diseases of poultry and man

There are four distinct stages in the life of a tick, viz., the egg, the larva (or seed tick), the nympha (intermediate stage) and the adult (mature stage).

When an adult female has fed to repletion (becomes engorged) on an animal it loosens its hold and drops to the ground; it then crawls into some little sheltered nook or cranny and thereafter lays its batch of eggs, which vary in number from a few thousand up to 18,000, depending on the species. As laying progresses so the tick gradually shrivels up and eventually dies.

After a variable lapse of time, a few weeks to several months depending on the surrounding temperature, the eggs hatch giving rise to the minute larval (seed) ticks. These crawl up on to the grass or bush and wait until they are brushed off by some passing animal. Having thus reached their host they crawl about until they find a suitable spot at which to bite in with their mouth-

parts and there become attached and feed. They remain feeding at this site of attachment until replete, i.e., they have now become fully engorged larvae. They are still extremely small, and will not feed again until they have undergone a moult to become nymphae. From this stage (engorged larvae) different species of ticks behave in different ways—some undergo their first moulting on the animal on which they have been feeding, e.g., the Red (or Red-legged) tick and the Blue tick, whereas others become detached, drop to the ground and undergo their moult there, e.g., the Brown, Bont-leg and the Bont ticks.

In the nymphal stage the procedure is repeated, i.e., the still extremely small unfed nympha gets on to an animal (unless, as in the case cited in connection with the Blue and Red-leg ticks, it had undergone its moult on one), attaches and feeds to repletion, thus becoming a fully engorged nympha. At this stage it is somewhat smaller than a small match-head. Just as in the case of the engorged larva, the engorged nympha also will not feed again until it has moulted into an adult. With the exception of the Blue ticks, which undergo even their second moult on the original host, the engorged nymphae become detached, drop to the ground and there moult to become adults.

In the adult stage the sexes are differentiated. Both males and females on first emerging from the nymphal moult are fairly small and flat. These adults also have to get on to animal (except in the case of the Blue tick which is already there) and then become attached and feed to repletion. Whereas the males remain much the same size as when unfed the females become more and more enlarged as feeding progresses until finally they are tremendously distended. During the period the female is feeding, or rarely even before she is attached, copulation occurs, the smaller male being found on the underside and towards the head-end of the female. When the female has fed to repletion and become fully engorged she becomes detached, drops off and proceeds to lay her eggs, thus completing the life cycle. The males may also drop off, but it is not unusual for them to remain attached for a considerably longer period on the same host.

Thus it may be seen that we have three main classes of these ticks, the one-host tick (Blue tick) which remains on the same animal from the time it first gets on as an unfed larva until it drops off as an engorged adult; the two-host tick (Red tick) which passes its larval and nymphal stage on the same host and then drops off to moult into an adult, which then must again find a host on which to feed; and finally the three-host tick (Brown, Bont-leg, Bont ticks) which feeds as a larva on one host, drops off, feeds as a nympha on its next host, drops off and feeds finally as an adult on a third host.

In the case of the one-host tick, therefore, it is obvious that it cannot both acquire infection from one beast and give it off to another in the same generation. What actually happens is that infection may be picked up during the larval nymphal or adult stage from the particular beast on which these stages have been spent, and then passed on through the eggs to the next

generation to be given off to the next beast by the larvae or nymphae or adults. The Blue tick is a known transmitter of Redwater and actually gives off its infection in the larval stage, though it is possible for the infection to persist even to the third generation, that is through two egg stages.

In the case of the two-host ticks infection may be picked up in either the larval or nymphal stage from the particular beast on which these are spent and then given off in the adult stage to the next host, or alternatively picked up in the adult stage and passed on through the egg into the next generation.

Finally with the three-host tick the possibilities are that infection may be picked up in any stage from one beast and given off in the following stage to the next host, including the possibility of an adult acquiring infection and passing it on through the egg to the next generation.

The above illustrates the various possibilities of how infection may be picked up and given off by the various main groups of ticks. The actual method of transmission of different diseases by different ticks has in many instances been accurately worked out and is diagramatically illustrated below in connection with the commoner disease and transmitters. An essential feature to be remembered is that a tick will not pick up and give off infection in the same stage of its development for the simple reason that it must complete that particular stage on one host—if, for example, an adult tick is feeding on a sick beast it is useless to detach it with the object of getting it to attach again, feed on and transmit infection to a test animal. The general rule is that when once a tick has become attached and commenced to feed, no matter what stage it is in, it will not, if removed and placed on another beast, again attach and feed.

From the table, therefore, it is quite obvious that to elucidate the exact manner in which any given disease is transmitted by ticks involves a considerable amount of work.

Where the disease can be produced by means other than ticks, e.g., by direct inoculation of blood from a sick to a healthy animal, the investigations are greatly simplified. For example, if one were trying to find out whether and how ticks transmit Redwater, one could easily reproduce the disease by inoculation and feed various stages of different species of ticks on it while it was reacting, and then feed these ticks later in their different stages on a susceptible beast and so determine which species was the transmitter and at which stages of its life cycle it picked up and gave off infection.

There are some tick transmitted diseases, however, that normally cannot be established by inoculation, e.g., East Coast Fever, and the problem in such cases is far more difficult as it makes one entirely dependent on naturally contracted cases of the disease for the purpose of preliminary investigations of the method of transmission. It will be appreciated that in such cases a considerable time might elapse before the problem can be solved, more especially when the course of the disease being

investigated is short, i.e., the time that elapses between the first appearance of symptoms and occurrence of death or recovery.

In this Colony there is at least one tick-transmitted disease of cattle, a form of Theileriosis, in which the actual method of transmission has so far not been determined. There is no doubt that when the right set of conditions arise rapid progress in clearing up certain points which are at present obscure will be made. In the meantime, however, in spite of the absence of an exact knowledge of transmission the important fact that this disease has been proved to be tick-transmitted does enable control measures to be adopted. These, as in the case of all tick-transmitted diseases, are based on the knowledge of the life cycle of ticks and consist of conscientious dipping and where necessary hand dressing.

EXPLANATION OF SYMBOLS.

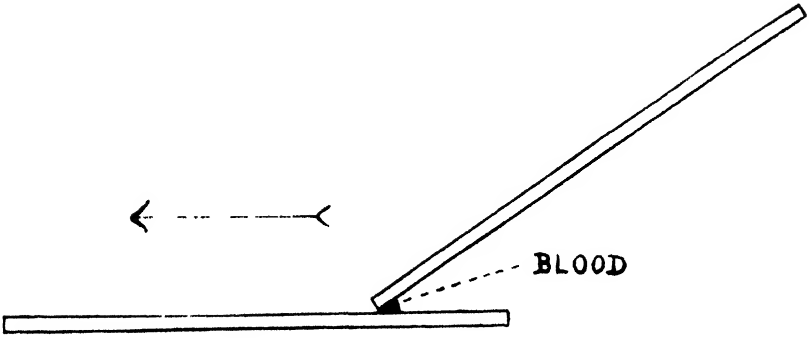
× = Stage at which infection is picked up by the tick when feeding on an infected animal.

→ = Stage at which infection is given off when feeding on a a susceptible animal.

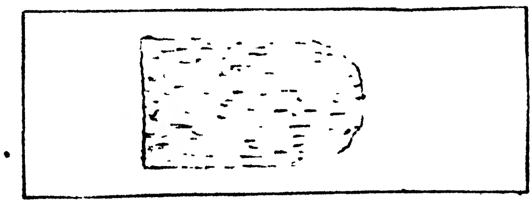
. . . = The dotted line in the case of the Blue tick transmitting Redwater and the Bont tick transmitting Heartwater indicates that if the infected tick feeds on a non-susceptible host infection is retained over the stage or stages shown and then given off subsequently when a susceptible host is fed upon.

NOTE.—It should be noted that although infection may be picked up in a particular stage it is not necessarily given off in the immediately following stage, and also that infection may not be picked up at every stage; for example, one might expect the Dog tick to pick up Biliary Fever infection in the larval stage and give it off in the nymphal, or pick it up in the nymphal and give it off in the adult, or pick it up in the adult stage and give is off in the larval stage, whereas it actually only picks up infection as an adult and the infection passes through the egg, larval and nymphal stages before being given off.

Showing the method of holding the smear glasses when making a blood smear.



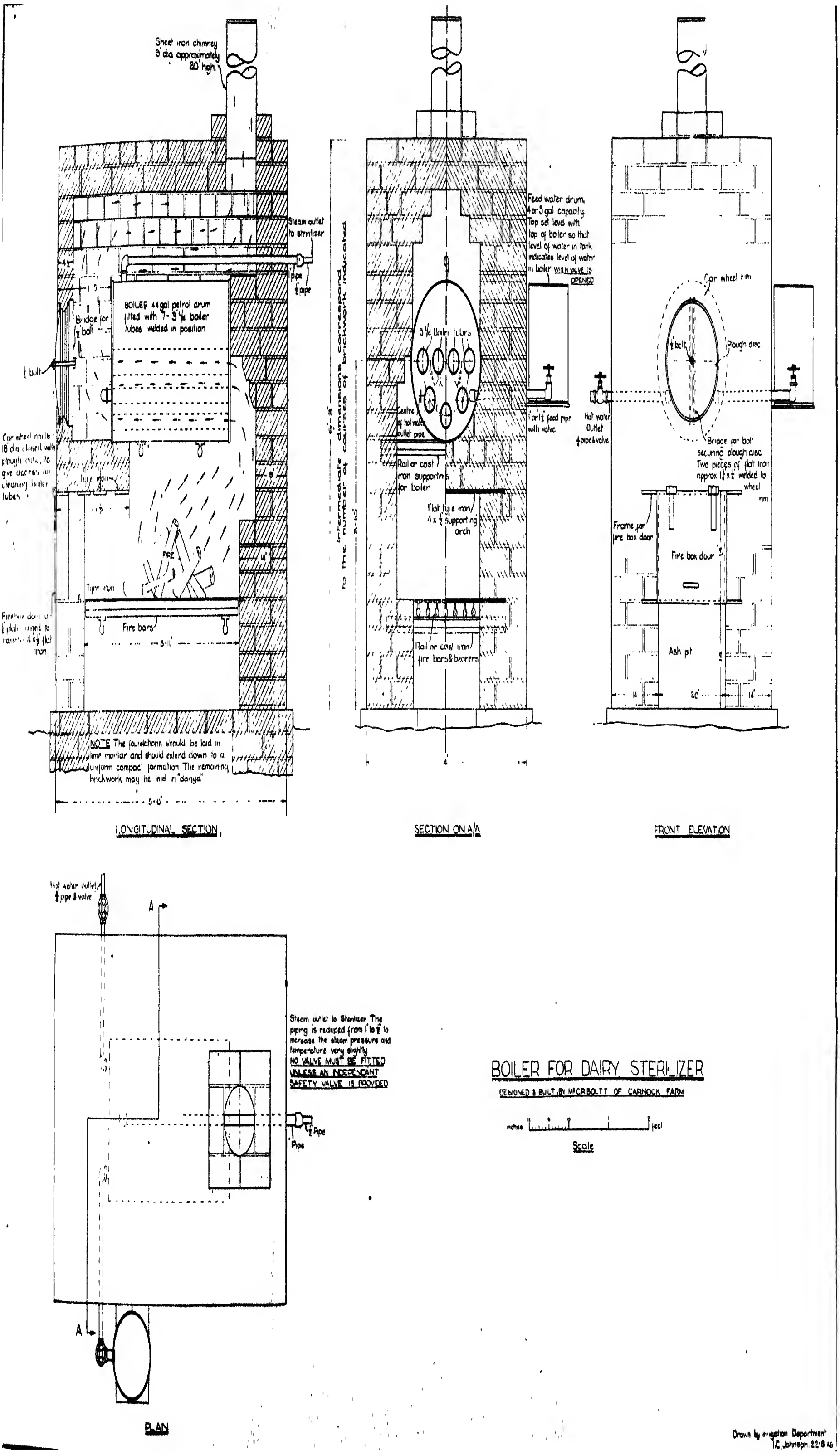
Relative position of the two slides and the drop of blood at the commencement of making a blood smear.



The film in a well prepared blood smear should extend over and be of similar shape to the shaded area above, and should be uniformly thin.

TRANSMISSION METHODS.

Disease.	Cause.	Tick.	No. of Hosts.	Larva	Nympha	Adult	Egg	Larva	Nympha	Adult	Egg	Larva
Redwater (Piroplasmosis)	Babesia bigemina	Palpoboophilus decoloratus (Blue tick)	One									
		Rhipicephalus appendiculatus (Brown tick)	Three									
		Rhiphicephalus evertsi (Red-leg tick)	Two									
Gallsickness (Anaplasmosis)	Anaplasma marginale	Palpoboophilus decoloratus (Blue Tick)	One									
		Rhipicephalus simus (Black-pitted tick)	Three									
East Coast Fever (Theileriosis)	Theileria parva	Rhipicephalus appendiculatus (Brown tick) Rhipicephalus simus (Black pitted tick) Rhipicephalus capensis (Cape brown tick)	Three									
		Rhipicephalus evertsi (Red-leg tick)	Two									
Heartwater (Rickettsiosis)	Rickettsia ruminantium	Amblyomma hebraeum (Bont tick)	Three									
Mild Gallsickness (Theileriosis)	Theileria mutans	Rhipicephalus appendiculatus (Brown tick)	Three									
		Rhipicephalus evertsi (Red-leg tick)	Two									
Spirochaetosis of Cattle	Spirochaeta theileri	Palpoboophilus decoloratus (Blue tick)	One									
		Rhipicephalus evertsi (Red-leg tick)	Two									
Biliary Fever of Horses	Nuttallia equi	Rhipicephalus evertsi (Red-leg tick)	Two									
	Babesia caballi	Dermacentor reticulatus	Three		(Same tick)							
Biliary Fever of Dogs	Babesia canis	Haemaphysalis leachi (Dog tick)	Three									
		Rhipicephalus sanguineus (Brown dog tick)	Three									
		Dermacentor (reticulatus and venustus)	Three									


Sheet iron chimney 9" dia approximately 20' high
Steam outlet to sterilizer
1" pipe
¾" pipe
BOILER 44 gal petrol drum fitted with 7 - 3¼" boiler tubes welded in position
Bridge for ½" bolt
½" bolt
Car wheel rim for 18" dia closed with plough disc, to give access for cleaning boiler tubes
Tyre iron
FIRE
Tyre iron
Fire bars
Firebox door of ¼" plate hinged to framing 4 x ½ flat iron
3'-11"
NOTE The foundations should be laid in lime mortar and should extend down to a uniform compact formation The remaining brickwork may be laid in "dagga"
5'-10"
LONGITUDINAL SECTION
Intermediate dimensions correspond to the number of courses of brickwork indicated
6'-8"
3'-10"
Feed water drum 4 or 5 gal capacity Top set level with top of boiler so that level of water in tank indicates level of water in boiler WHEN VALVE IS OPENED
3¼" Boiler tubes
Centre of hot water outlet pipe
Rail or cast iron supporters for boiler
Flat tyre iron 4 x ½ supporting arch
Rail or cast iron fire bars & bearers
1 or 1½" feed pipe with valve
4'
SECTION ON A/A
Car wheel rim
½" bolt
Plough disc
Hot water Outlet ¾" pipe & valve
Bridge for bolt securing plough disc Two pieces of flat iron approx 1½ x ½ welded to wheel rim
Frame for fire box door
Fire box door
Ash pit
14"
20"
14"
FRONT ELEVATION
Hot water outlet ¾" pipe & valve
A
Steam outlet to Sterilizer The piping is reduced from 1" to ¾" to increase the steam pressure and temperature very slightly
NO VALVE MUST BE FITTED UNLESS AN INDEPENDANT SAFETY VALVE IS PROVIDED
¾" Pipe
1" Pipe
A
PLAN
BOILER FOR DAIRY STERILIZER
DESIGNED & BUILT BY MR C.R.BOLTT OF CARNOCK FARM
inches
feet
Scale
Drawn by Irrigation Department
I.C. Johnson. 22.8.46

The Boltt Dairy Boiler

By THE DAIRY BRANCH.

Since the publication, in 1946, of the original bulletin on the Boltt Dairy Boiler, a considerable number of these boilers has been installed by dairymen throughout the country. Their efficiency has been fully established, whilst their economy of operation is shown by the fact that the original boiler designed by Mr. C. R. Boltt, of Carnock Farm, Salisbury, is in its third year of continuous service, being fired twice daily, and has had no money spent on it for repairs or alterations.

The boiler designed by Mr. Boltt, while not as easy to operate as an electric steriliser, satisfies the demands of the larger dairyman who is not served with electric power, in that it is reasonably cheap to build, is economical to operate, and raises the temperature of the sterilising cabinet to sterilising point.

DESCRIPTION.

The boiler, as detailed on the drawing, is merely a petrol drum fitted with a series of boiler tubes and provided with arrangements for filling, drawing off hot water, and an outlet for steaming.

The petrol drum is made of very substantial material and should be serviceable in the boiler form for several years. It should be borne in mind, however, that the petrol drum was never intended to withstrand pressure, and in order to avoid the danger of building up steam pressure and of possible mishaps, the steam outlet pipe should on no account be fitted with a valve or stop cock.

In theory the fullest possible use is made of the fire in this type of boiler. The heat plays first on the bottom of the drum, the hot waste gases then pass through the centre and finally over the top of the drum.

To operate this boiler to the best advantage, it is essential to create a good draught. To achieve this a reasonably tall chimney is necessary.

Excluding the brickwork, details of which are shown on the drawing, the work involved in converting the petrol drum into the boiler cannot be done on the average farm. The task of cutting holes in the ends of the drum for the tubes is no easy task; then again the tubes require to be welded into position. This calls for a welding plant, which is not commonly found in the country.

POINTS TO BE NOTED IN CONSTRUCTION.

1. Fitting of boiler tubes. Tubes must be welded and not brazed to the drum. Unequal expansion of metals has caused brazed tubes to break away from the ends of the drum on heating.

2. Water feed. It has been found useful to fit a non-return valve between the water feed tank and the boiler. This valve allows free flow of water to the boiler, but prevents steam from blowing back. The use of a non-return valve makes it unnecessary to fit a shut-off valve in the feed tank, as shown in the drawing. Where water is laid on it is suggested that a ball-cock be fitted to keep the water in the feed tank at a constant level, which will be the same as the desired level in the boiler itself. The fitting of such a ball-cock would eliminate the need for filling the supply tank by hand, and watching to see that the water level does not fall so low as to expose (and so burn out) the boiler tubes.

3. When constructing this type of boiler and cabinet combination, care should be taken to erect the cabinet as near to the boiler as is possible, and to insulate the steam pipe. This ensures minimum loss of heat between the boiler and the cabinet and, moreover, reduces the time taken to heat the cabinet. The steam pipe should be introduced through the bottom of the cabinet. To exclude pockets of cold air forming in the cabinet and thus reducing its efficiency, a half-inch hole should be drilled in the top of the cabinet. This allows a certain amount of steam to escape and promote free circulation of steam within the cabinet.

PERFORMANCE.

Under test, this boiler when filled raised the temperature of water from cold to boiling point in under 20 minutes, and then raised the temperature in an insulated galvanised iron cabinet, 6′ × 6′ × 3′ filled with dairy utensils, to 202 degrees Fahrenheit in under 20 minutes.

This performance compares favourably with the electric steriliser, which takes from 40 to 60 minutes to reach sterilising temperature.

In addition, it should be noted that sufficient hot water can be drawn off for washing utensils, so that it is not necessary to maintain a separate hot water system.

COST.

With the rising cost of materials the price of a boiler, fittings and steaming cabinet is now just under £30. No accurate figure can be given for brickwork and labour, as the farmer may, or may not, do this work himself.

Drawings may be obtained from the Chief Dairy Officer, P.O. Box 387, Salisbury.

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Feeds for Poultry and How to Use Them

By G. H. COOPER, Chief Poultry Officer.

During recent years considerable work has been done and knowledge gained in the use of many feeds for poultry. Most of this work concerns the rearing of chickens and feeding for egg production. Other classes of poultry have had less attention paid to them and also much work in connection with digestibility trials with poultry remains to be done. However, it is felt that a comprehensive list of foodstuffs and the latest knowledge applied to their use for poultry feeding will be of great assistance to farmers in Southern Rhodesia. Special attention has been given to the use of Rhodesian experience and analyses of feeds where available.

THE FEEDSTUFFS.

Barley. This grain is not used to any extent in Southern Rhodesia. Where it is available it may be used, but it is not so palatable or digestible as maize or wheat. Good heavy grain may be used as a substitute for maize, especially in fattening rations. It may be fed as a scratch grain or in the form of finely-ground barley in the mash, where it may be useful to add variety.

Beans. Various types of beans are occasionally fed to poultry, usually as cracked beans as a grain or in the mash as bean meal. As beans in general are not considered very palatable to poultry they should probably be fed as bean meal in the mash and not form more than 10% of the ration. Velvet beans have been shown to be unsuitable for poultry feeding.

Buckwheat. At present this feed is not extensively grown and it is not eaten readily by fowls. As buckwheat middlings it may be fed in the mash, but the hulls should be sifted out. When fed to poultry it produces a white flesh and light-coloured yolks. Greater use could be made of this feed—up to 20% of the mash may consist of ground buckwheat.

Cassava or Tapioca Meal. This feed is probably the best substitute for maize meal available and may be used in the same quantities in any mash. Up to 40% in a mash has been successfully fed for egg production.

Coconut Meal or Copra Meal. May be used in the same manner as Palm Kernel Meal.

Cottonseed Meal. Has been used for poultry feeding with somewhat contradictory results. It is generally acepted as being not a very desirable feed for poultry. It is high in protein and should be fed where used as a protein supplement to the cereal grains. If fed in large amounts it may prove injurious. Not more than 5% in the mash may be fed for chickens, but it should not be used in laying rations as it produces a "pink-white" in eggs.

Cowpeas. This legume contains a large amount of protein with the essential amino-acids which are lacking in the grains; this is true of most of the leguminous seeds. Cowpeas may be somewhat unpalatable to poultry, but if the birds are accustomed to them whilst young they may be fed to advantage either as a grain or as a mash ingredient when ground. They should be used as an additional protein supplement to the cereals. They are usually too expensive for feeding.

Gluten Feed. Consists of the gluten and bran of maize. It is high in protein but of a similar quality to the proteins of the grains and therefore unsuitable for use in mashes as a protein supplement to the cereals.

Hominy Feed. Consists of the bran or hull, germ and some of the starch. Its composition is similar to maize but is higher in minerals and fat. It is an excellent feed for poultry, but is rarely on the market in this country.

Kaffir Corn and Kaffir Corn Meal. May be considered only fairly palatable and nearly equal to maize in feeding value. It has a composition between wheat and maize. It may be used whenever available.

Maize. The most valuable feed for poultry owing to its high digestibility and palatability. It is produced on nearly every farm and is always available. It cannot be fed, however, without supplements of proteins from other sources. Yellow maize is preferable, as it alone carries Vitamin A and is more palatable than white maize. Also, it gives a deep yellow colour to the yolk of eggs, and, in yellow-skinned breeds, to the skin pigments. Flint maize has usually a smaller grain and need not necessarily be cracked for poultry feeding, though cracked grain is preferable. Whole grain may be soaked for 24 hours with advantage. It is also somewhat higher in protein than dent maize. The best maize to feed as grain, therefore, is a yellow flint which is fed cracked. There is a certain amount of loss and extra cost in grinding, but it does improve the digestibility of the whole grain.

Maize Meal. Serves the same purpose in the mash as the whole grain does in the scratch feed. It should be ground fairly fine or otherwise the birds will tend to take it from the mash mixture owing to its palatability. Yellow maize is again preferred. Maize must be fed with discretion and not heavily to old birds, especially the heavy breeds, or birds which are not in production. Birds just through the moult should not be heavily fed on maize before laying. When there is a tendency to thin-shelled eggs or cases of prolapsus, it should be fed very lightly. It has a tendency to produce an accumulation of yellow fat internally, but when fed in conjunction with other feeds is the best of all cereals for egg production.

Maize and Cob Meal. Usually known as corn and cob meal, is made by grinding the grain and cob together. If the grain is shelled the mixture to be used is four parts of maize meal to one part of cob meal. The cob has little nutritive value, but may be added for bulk in some mashes. Too much must not be fed.

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Maize Germ Meal. Sometimes available and may be used for a portion of the maize meal in rations where it is necessary to bring up the protein content slightly without increasing the animal feed. It is slightly higher than maize meal in protein.

Millet Pearl (*Pennisetum typhoides*). Known in Rhodesia as "N'youti," or "Munga." It is used very extensively as a chicken feed and for laying hens. This variety of millet has not so hard a shell as many others and is more desirable. It is supposed to have a beneficial effect upon the kidneys. It is very palatable and so should not be fed in too great quantities, especially to chickens, as it is likely to cause crop trouble. It has a large germ and probably carries enough Vitamin A to support nearly normal growth, which is important when white maize is fed and green feed is lacking.

It is similar to wheat in composition. Ground into a meal it may with advantage form part of the mash feed. As a grain it is very useful to induce exercise, as it is small and eagerly sought. For poultry feeding it is considered as valuable as yellow maize. It carries more protein than maize.

Milo. May be considered similar to Kaffir Corn, but not of quite as high feeding value or palatability.

Oats. The value of oats depends upon its weight. A light oat, which is mostly hull, is not suitable, and unfortunately most oats grown in this country are considered light. Heavy clean oats or oatmeal is greatly relished by chickens and is a very desirable feed. A small portion of oatmeal or Sussex ground oats is frequently fed to small chickens, but is usually too expensive to feed otherwise.

Palm Kernel Meal. This feed has been used a great deal during the war when pollard was unobtainable, and it has proved to be a useful substitute feed. It may be included in mashes up to 15% for chicks and up to 20% for adults.

Pea. Field peas are usually too high in price to be used as a poultry feed, but pea meal is an excellent feed for all classes of stock, being high in protein and of the correct kind to balance the cereal grains.

Peanut Meal (with shells, not extracted). This feed consists of the ground kernels and shells and may be successfully used as a mash ingredient for all classes of poultry. It is fairly high in protein, and very high in fat, which is its chief disadvantage. It may comprise up to 10% of the mash for laying hens without causing trouble; however, the mash should contain other feeds low in fibre and oil. It is not so good a feed as the extracted peanut meal, but where peanuts are grown on the farm it may be used with greater economy, perhaps.

Peanut Meal (with kernels only). The ground kernels form a similar feed to that including the shells, but contain more protein and more fat with less fibre. This feed may be used in small quantities in the mash, but should be used with care.

Peanut Meal Extract (oil extracted meal from shelled nuts). This feed has been shown to be an exceedingly valuable protein supplement feed for the cereal grains, being high in protein, carrying the desirable animo-acids and some valuable vitamins. It may be used for all classes of stock and may replace in part the usual protein rich feeds of animal origin, with the addition of the necessary minerals.

Pollard. The by-product of wheat in the production of flour. It is similar to middlings, shorts, thirds, etc., and normally contains fine bran and some flour. It is one of the most widely used feeds in all mashes and is an excellent feed, especially when combined with wheaten bran. Too much in the mash should be avoided as it is high in gluten and may form a sticky mass in the mouth and interfere with heavy mash consumption. It must be balanced with proteins from animal or suitable vegetable sources. It should form a large part of the cereals in all mashes.

Rice. Is not used to any extent, but may be used as a fattening feed, being high in carbohydrates. It may be used in the grain portion of the ration. Rice by-products may be used to a limited exent only, because of a high fat content.

Rice Bran. Can be successfully used as a substitute for wheaten bran. It should contain a minimum of husks, which are highly indigestible. It is very high in manganese, which is desirable in most mash mixtures.

Soya Bean Meal (oil not extracted). The soya bean ground into a meal. This feed is high in protein and fairly high in fat and may be used in a mash in a similar capacity as peanut meal (not extracted), but is preferred to the latter because of its high protein value and lower oil content. It should become increasingly popular when this excellent legume is grown more extensively. It promises to be one of the most useful feeds, rich in the proteins necessary to balance the cereal grains which will be available to the farmer without undergoing any manufacturing process. It may be recommended as a protein supplement to the cereal grains and may substitute most of the purchased animal protein feeds if necessary. When ground the seed should be mixed with a certain proportion of maize owing to its oil content which makes grinding otherwise difficult. It should be baked to a brown colour before feeding.

Soya Bean Oil Meal (fat extracted). Owing to the fact that other products such as peanuts and coconuts have a higher oil content than soya beans, they are not used extensively to-day for oil production. When they are, however, the resulting cake with the oil extracted is an excellent feed for all poultry and is better than the soya bean meal without the oil extracted. It is very high in protein and possesses all the attributes of the best protein-rich supplements for the cereal grains. Where procurable at reasonable prices it may be used, after baking, with advantage as a protein feed, with the addition of the necessary minerals.

Sunflower Seed. This seed is extensively used in the grain for adult birds and may form 10% of the grain ration at all times and more especially during moulting periods. This seed is high

in oil and must be used with discretion if peanut meal or soya bean meal are included in the mash, as too high a percentage of oil in the ration may cause digestive disturbances. The small black variety is most commonly used. It carries a reasonable amount of protein and is high in fibre.

Sunflower Head Meal (without seeds). This feed consists of the ground-up sunflower head after the seeds have been thrashed out. It is becoming popular in certain areas where wheaten bran is expensive. It is used as a bulky feed and may replace up to 50% of the wheaten bran in a mash. It has been used experimentally to supply the entire bulk in a ration, and with apparent success. It is high in fibre.

Sunflower Head Meal (with seeds). This feed is similar to the last-named, except that the seeds are not thrashed out before grinding. It is not only higher in fibre but also higher in protein and oil. When these feeds are used no other fibrous feeds should be included and too much should not be fed. A better grade of meal is produced if ground finely in a hammer mill.

Wheat. The price of wheat usually makes it too expensive to use as a poultry feed here, but it is one of the best grain feeds for all classes of stock, being very palatable. It may always be included in the grain ration.

Wheat Bran. A by-product of flour manufacture consisting of the outer layer of the wheat kernel. It is probably the most popular mash ingredient for adding bulk to the ration. It is excellent for mixing with cereal meals, though its protein is deficient and does not help to balance that of the other cereals. It is high in ash, has a cooling effect upon the digestive tract and is slightly laxative. It seems it is fed more for its physiological effect than for its feed value.

Wheat Feed. When wheat is ground into a meal it forms an excellent ingredient for the mash and may partly replace both the bran and pollard in the mash if used, otherwise it may be used as a feed in any mash according to its value as shown in the table of feeds.

Wheat Screenings. This feed, consisting of shrunken and cracked wheat, may often be purchased at low prices, and if it is free from contamination with weed seeds and dirt is an excellent grain feed for all poultry. Actually, shrunken wheat has been shown to be higher in protein than the full plump wheat. Wheat screenings may be ground into wheat feed if desired.

FEEDS OF ANIMAL ORIGIN.

These feeds are used chiefly as sources of proteins to balance the carbonaceous feeds. As birds are omnivorous, at least one feed of animal origin in the ration is usually recommended, but more than 6% of animal protein feed in the total ration is wasteful and injurious.

Blood Meal. A by-product of the slaughter house, it is always available and is probably the cheapest form of protein, of which it has a very high percentage. However, all authorities are

agreed that it is unpalatable to poultry and is not generally recommended for this reason. A small proportion of the protein feed may consist of blood meal if desired, but more than 5% in the mash is not advisable. Higher percentages cause purging and paralysis.

Blood (dried). This product is high in protein but lower than commercial blood meal in this respect. The same remarks as to unpalatability apply, however, but with perhaps less emphasis.

Blood (fresh). Where this is available it may be used with advantage, and it may often be obtained for the taking away. Fresh blood is palatable and high in protein. Do not feed it as a liquid to birds as it will make a nasty mess and often leads to feather-picking or toe-picking and cannibalism.

Fresh blood may be poured into a closely-woven sack or bag, suspended in a tub of boiling water, when it clots readily. Let it cook thoroughly to a solid lump, then break up and mix with mash. Approximately two pints of fresh blood per 100 lbs. of mash will be equivalent to 5% of blood meal.

Bone Meal. This product is fed more for its phosphate of lime content than for its protein content, though it has an appreciable amount of the latter. It is therefore more of a mineral supplement. About 2% in the mash is sufficient. When meat and bone meal is fed as a protein supplement it is undesirable to add further bone meal to the mash.

Bone Meal (fresh cut). Fresh bones may often be obtained for next to nothing, and when cut in a green bone-cutter form a palatable and highly nutritious feed, rich in mineral matter and protein. It should be fed fresh and not more than one ounce per fowl every other day given, otherwise digestive trouble may follow from too heavy feeding. If properly dried in the sun it may be kept satisfactorily. It should not be fed if at all tainted. It fits best into general feeding practice if used as a tit-bit occasionally to the birds, especially when it is necessary to encourage egg production.

Buttermilk. This is a very excellent feed for all poultry, and more especially small chickens. Unless fed ad lib. without water, not sufficient can be digested to balance the cereal grains, and therefore half the amount of other animal protein feed is used in the mash. It is similar to separated milk in feeding value. Dried and semi-solid buttermilk are not available as yet, but are considered one of the very best protein supplements in other countries. Be sure that buttermilk has not an excess of common salt in it before feeding.

Crayfish Meal. A feed made from grinding the shells of crayfish is fairly high in protein and exceptionally so in desirable mineral substances. It may be safely used as a protein supplement to the cereals where procurable at a reasonable price. It should be purchased on the value of its protein content.

Fish Meal. A concentrated protein-rich feed of high quality; is excellent for balancing the carbonaceous feeds. It is usually

higher in protein than meat meal and also higher in price. It is often not procurable and then difficulties arise.

Locust Meal. Dried locusts ground to a meal form a very desirable protein-rich feed for poultry. Whenever available it should be used in the place of other purchased protein feeds, such as meat meal. Experiments have shown that there is no danger in utilising locusts as feed which have been killed by spraying with Government formula arsenic sprays.

Meat Meal (high grade). Pure meat meal of high grade containing no bone, hoof, hair or other contamination is one of the best by-products of the slaughter-house for use in poultry rations as a protein-rich feed. It is high in protein, containing the amino-acids deficient in the grains.

Meat Meal (average 50% protein). This product is most commonly used and is the usual feed supplied when "meat meal" is purchased. It is similar to high-grade meat meal but contains more indigestible materials and less protein.

Meat and Bone Meal. Meat meal with a varying amount of bone meal is a good feed for poultry, carrying less protein than meat meal. Meat meals generally should be purchased on the guaranteed protein content. A good sample should be free from hair and gelatinous substances and have an odour of cooked meat. Good samples are produced locally, and this feed should form the animal protein-rich feed in this country as a general rule. When fed, no further bone meal should be added.

Meat (fresh). Like fresh blood, meat may be used by mincing and mixing with mash to form a wet mash. Under no circumstances should putrid meat be used. It is best fed like green bone as a tit-bit, on the average-sized poultry farm.

Meat (dried). When fresh meat is minced and thoroughly dried in the sun it may be used in the mash in the place of meat meal and is equally as good. It may be dried in small pieces the size of a wheat grain and fed as a scratch feed when extra protein is considered necessary. In this way meat may be preserved on the farm and made use of when needed. When cattle are dying from drought, they may be utilised in this manner. Meat from antelope, donkeys, horses, etc., is equally good, but must be fresh and free from taint.

Milk (separated). Whole milk is seldom fed to poultry, and, indeed, it is unnecessary, as separated milk is actually better, containing the same protein and less fat. Separated milk may perhaps be considered the very best protein supplement to the cereal grains. Where it is used, no other minerals are required except lime. Skim-milk may be fed to all classes of poultry and is especially valuable for young growing stock. It should always be fed in the same condition, and because of this fact and also that it is difficult to keep sweet in summer, it is the best policy to feed it sour at all times. The sour skim-milk should be thoroughly stirred before being fed as a drink or used to mix a wet mash. If desired, the curds may be drained and fed in the form of cottage cheese mixed with mash. It has been shown that

sour skim-milk fed ad lib. without water to drink, together with cracked maize, forms a balanced ration for both growing chicks and laying stock. Skim-milk and buttermilk may be mixed for feeding and are of equal value. They both contain Vitamins A and B_2.

Whey. Milk whey is low in protein because of the loss of casein in the making of cheese. It is therefore not a substitute for other animal proteins, but it contains the Vitamin B_2 which is so essential for good growth and hatchability. Whey should always be used for poultry-feeding where available, though the animal protein in the mash should not be reduced more than 2 or 3%.

DRY GREEN MEALS.

The dry green meals are fed as a source of Vitamins A and B_2 and are of great importance in this country, where at times succulent green feeds are unobtainable.

Lucerne Meal. The best samples are made from the leaves only, but the usual meal purchased is made by milling hay from the crop. The value of this feed may vary considerably according to its quality. The essentials in a good-quality meal may be summarized as (1) that the meal is a good bright green colour; (2) that it contains a minimum of stems; (3) that it has not been adulterated with a poor grade of hay. Lucerne meal is high in fibre and must not be fed in too large a quantity. It contains some lime and protein, but is chiefly fed for its vitamin content, of which it contains all those of importance. Other legume hay meals of good green quality may be used similarly to lucerne meal. Seven to 10% green leaf meal in the mash is sufficient.

Sunflower Leaf Meal. The leaves of the sunflower plant if stripped at intervals, dried and ground into a meal, may be used in the mash in the same way and for the same purpose as lucerne meal. It is likely that the sunflower leaf meal is equally as good a feed from the vitamin content point of view as lucerne meal. The meal should be green and should be dried carefully out of the sun and dew to preserve the vitamins. It contains less fibre than lucerne meal if the thick ribs of the leaves are not used. The quality of sunflower leaf meal is gauged by its green colour and freedom from thick ribs and stems. It is used largely in Rhodesia in the place of lucerne meal, as the sunflower can be grown anywhere and provides other useful feeds as mentioned elsewhere.

Legume Hay Meals. Dry green meals made from milling a good quality hay from practically any legume hay crop may be used in poultry mashes in the same manner as lucerne meal. Bean hay meal, peanut hay meal, cowpea hay meal, have all been used with good results. Again the value of the meal depends upon having a good green colour and freedom from excess woody stalk.

SUCCULENT GREEN FEEDS, ROOTS, ETC.

Succulent green feed plays a most important part in poultry feeding. Its value lies not in the feed value as expressed in

proteins or carbohydrates but in its vitamin content and its other health-promoting properties, its effect on the digestive system, such as distension of the intestines, thus enabling the bird to make greater use of other feeds, and in providing variety. Not least of its value lies in its promotion of good health, thus affecting a great saving from disease and loss of products. It has a cooling effect on the system which is very beneficial in a hot climate, and it assists very materially in the most economic production of both eggs and table birds. Most types of succulent green feed should be finely chopped and fed fresh to the birds in troughs or wire baskets.

Cabbage. The leaves of cabbages or small unmarketable heads make an ideal succulent green feed for poultry and one that is greatly relished. The green leaves contain more Vitamin A than the white portion.

Cactus, Spineless. In times of drought or in districts where it is difficult to grow other greens, spineless cactus may come in very useful indeed. As a standby, some should be grown on every farm. The leaves are cut into strips with a knife, and the birds, when accustomed to it, will eat all the succulent feed from the centre. It most likely carries Vitamin A.

Carrots. The best variety to grow is the yellow carrot, which has been shown to carry Vitamin A, which is not the case in other varieties. These carrots are the best root crop available to substitute for fresh greens. They are very beneficial for turkeys. Yellow carrots should be chopped into small chunks for feeding.

Edible Canna. For the best results this crop requires plenty of water and a soil rich in humus, when it will give tremendous yields, even in the winter in frost-free areas. It is relished by poultry when they are accustomed to it.

Grass. Green grass is the natural feed for poultry, and, when young and succulent, is very beneficial Free range on green grass is ideal. Green grass contains all the vitamins of importance.

Lettuce. For chickens this succulent green feed is excellent, as it is soft and easily digested. All classes of stock greatly relish it. It contains the essential Vitamin A and may safely be used wherever available.

Lucerne. Like green grass, lucerne contains all the known vitamins and is one of the most widely used green feeds. It also contains some protein and lime, which is essential for all poultry. It is fairly palatable and can hardly be bettered for all classes of stock.

Mangels. Where available, mangels may form a useful substitute for greens. They are low in Vitamin A, however, so this should be supplied by yellow maize or other feed. Mangels may be stored and when fed should simply be cut in half length-ways and the birds allowed to pick out the succulent feed.

Melon, Cattle (Majorda). This feed is grown on practically every farm, and in conjunction with spineless cactus may well replace the use of root crops as succulent feeds in this country. Melons, being green, probably contain Vitamin A in sufficient quantity. Where no succulent green feed is available they may be cut into quarters and placed for the birds to help themselves. Keep it out of the hot sun. Melons, when cut, soon become sour if not consumed and may cause digestive troubles, so they should be fed fresh daily, and all not consumed taken away at night. The seeds need not be taken out, they will do no harm. They can be stored for months, but should not be fed if bruised or decayed.

Oats, Green. Where available, green oats or green feed from other grains may be used for poultry feeding. They all contain vitamins. They should only be fed when young and succulent and not when fibrous and old. Green feeds of this type should be cut in a green feed cutter.

Oats, Sprouts. Where absolutely no succulent green feed or dry leaf meal is available, oats may be sprouted in an oat sprouter and fed to poultry ás a succulent and vitamin feed. The sprouts should be fed when green and about three inches high. Feed one square inch of the germinated oats and green shoots per hen. Munga sprouts may be used in the same way.

Onions. As a succulent green feed onions and green onion tops may be fed to poultry and have a beneficial effect on the system. They are especially valuable for brooder chicks on cold days or when they need a little cheering up. Too much must not be fed to laying stock, otherwise they may taint the eggs. Self-multiplying onions are the best to grow.

Potato. This crop is not generally fed and is not a vitamin supplement of any value. When available they may be used as a very useful substitute for the cereal grains. Potatoes should be boiled in their skins, mashed and fed in combination with bran, lucerne meal and meat meal up to 25% of the mash. Sweet potatoes, artichokes and cassava may be used in the same way.

Pumpkin. Like the melon, this feed is grown extensively and may be used as a succulent feed. It contains Vitamin A. The same remarks apply to pumpkins as for melons.

Rape. Where it is grown, rape and kale form excellent greens for poultry. Rich in Vitamin A, they may add variety to the green feed rations. Containing more green leaf, they are preferable to cabbage.

Silage. May be used in a ration when other more desirable feeds are unobtainable. It should be finely chopped, but not constitute more than 15% of the total food given daily. When given as a succulent substitute, not more than 2-3 lbs. per 100 birds should be fed daily, or "grass" eggs may result. The silage must always be of good quality.

Sunflower Leaf. The leaves of the sunflower plant may be plucked, chopped and fed to poultry as greens. Being somewhat

coarse, they are better suited to adult stock. They will contain Vitamin A.

Swiss Chard (Spinach Beet). This crop is an excellent one for poultry. It is a perennial and a heavy cropper. The leaves only are fed and form a soft succulent green feed rich in Vitamin A. It is an excellent crop for winter greens and is most palatable.

Other Greens. If birds will eat the chopped green food, almost any greens are suitable from a Vitamin A point of view. To get birds used to a change in greens mix with a little wet mash for a while. At times such greens as "m'sasa" tree leaves, cassava, mulberry, belhambra, paw-paw, banana and willow leaves have been fed and are certainly better than no greens at all.

MINERALS AND MISCELLANEOUS FEEDS.

In this class we have such essentials in the diet of poultry which are not strictly feeds but are necessary for health and production.

Oyster Shell. Hens laying a considerable quantity of eggs cannot get sufficient calcium from their usual feed to satisfy their requirements, therefore additional calcium is supplied to them in various forms, one of the commonest and best being ground oyster shell. Oyster shell or a suitable substitute should be available to laying hens at all times, but it is unnecessary for growing stock. Oyster shell should contain 95% carbonate of lime.

Marine Shell. Mixed marine shell is probably used to a larger extent than oyster shell in this country for the same purpose, as it is cheaper. However, mixed marine shell as a rule does not contain as much carbonate of lime as oyster shell and may often have other impurities which may make it more expensive than good oyster shell. It is frequently mixed with grit and sold as shell-grit.

Limestone Grit. Has been shown to be as satisfactory as oyster shell, provided it is of good quality. It contains more manganese, which may be deficient in some rations.

Limestone (Ground or Agricultural Lime). In order to be sure that all birds are receiving adequate lime in the ration, ground limestone is often added to the mash feed. This is a desirable practice. As a substitute, fine oyster shell or marine shell may be used in the mash. The price and lime content of these products should determine which is to be used in each case. Two per cent. of fine shell or ground limestone in the mash is usual.

Phosphates. Phosphorous is necessary to all poultry and must be added to the usual feed by means of a suitable supplement. The usual supplement to ensure an adequate supply of phosphorus is bone meal, which has been discussed elsewhere. Another supplement used is ground phosphate. It should be borne in mind that lime and phosphates cannot be stored or made use of by stock without the co-operation of Vitamin D or the

ultra-violet light of direct sunlight. Too much phosphorus may cause perosis in growing stock. The correct balance of calcium and phosphorus should be two to one.

Salt (common). Common salt supplies both sodium and chlorine, which are both required in small amounts by poultry. Salt also makes a feed more palatable and aids the digestion. If consumed by poultry in too large a quantity, however, it is injurious. About ½ to 1% in the mash is considered sufficient.

Sulphur. Frequently it is recommended that sulphur should be added to the feed of hens, and in certain cases it is useful. However, there is sufficient sulphur in the average feed for the requirements of birds. When fed, not more than 2% of flowers of sulphur should be added to the mash.

Manganese. A deficiency of this mineral may occur in practical diets and cause perosis or slipped tendons in growing chickens and turkeys, or deformities in developing embryos. As excess of phosphates and possibly calcium may also be responsible for perosis it is necessary to ascertain the reason before including manganese. Confinement on wire floors, as in batteries, and hereditary tendency may also be the cause.

An excess of phosphates or calcium may be remedied by reducing the bone meal in the mash.

A deficiency of manganese may easily be corrected by adding ½ lb. of manganese sulphate per ton of mash.

Feeds rich in manganese are rice bran, limestone, wheat bran, wheat middlings and oyster shell, especially the first two.

At times, small quantities of choline are also necessary to prevent perosis. Feeds containing choline are soya bean meal, pork liver, sardine meal and barley.

Charcoal. There is no necessity to feed charcoal, but it is considered an intestinal corrective and may be fed as such. It may be included in the mash at the rate of ½% and placed in hoppers for the birds to help themselves. Recently, however, it has been shown that charcoal has the power of absorbing vitamins and it would therefore seem that its use is questionable, especially when green food is in short supply.

Grit. The function of grit is to act as the birds' teeth to do the crushing and grinding of the food in the gizzard. Therefore, the most desirable quality in grit is its hardness. It is usual to have grit available in suitable sizes for all stock, and more especially to birds confined in intensive houses.

Condiments. Various condiments, such as mustard, pepper and proprietary articles, are fed to stimulate egg production, but it is considered an artificial reaction and the use of stimulants is questionable. They should be used in practice with great moderation, only supply sufficient to season the mash. They should never be fed as a regular practice.

Water. All classes of stock require an abundant and continual supply of cool, clear, clean water, except where skim-milk is fed

as the sole protein supplement to the grains, when it furnishes the water requirements. Where there is any doubt about the purity of the water it should be tested for impurities. The water must be kept out of the sun and in clean vessels. It must be renewed at least once daily. In severe cold weather tepid water should be given.

VITAMIN SUPPLEMENTS.

The vitamins are ranked equal in importance with proteins, carbohydrates, fats and mineral salts. They have been found to be essential for growth, reproduction and maintenance of health. and wherever there is prolonged deficiency in the ration of any of the vitamins, animals develop a characteristic deficiency disease or condition. Our knowledge of the vitamins is very incomplete.

The amount of vitamins required by poultry varies with the age and condition of the birds. These vitamins are found in natural foodstuffs in minute quantities and some feeds are entirely lacking in one or several of them; hence it is essential to know that the ration contains sufficient vitamins, otherwise deficiency disease will result. It is essential to know what feeds commonly used are rich in vitamins, and these feeds must be used.

Vitamin A. This is one of the most important vitamins with which we have to deal from a Rhodesian point of view. A lack of it causes a deficiency disease often called "nutritional roup," the correct name is "avitaminosis A."

A serious deficiency of Vitamin A causes the eyelids of animals to become granular and sticky: later, a film gathers over the eyeball and blindness results. In poultry this condition is usually accompanied by creamy-white pustules in the roof of the mouth and down the oesophagus, together with a secretion from the eyes which sometimes causes swelling of the face, because it cannot escape unless forced out by hand. An excess deposit of urates may be found in the kidneys, which may appear nearly white in colour.

Vitamin A deficiency may also cause slow growth in chickens, weakness, staggering gait, emaciation and ruffled plumage. The yellow pigment of yellow-skinned breeds is absent and the comb and wattles are pale. In adult birds, emaciation, weakness and ruffled plumage are noticeable, with a marked decrease in egg production and low hatchability of eggs.

The disease may easily be confused with roup, but may be distinguished from it by the fact that it is not infectious and that there is an absence of the formation of false membranes in the mouth and throat. Also the offensive odour associated with roup is absent.

Owing to the fact that Vitamin A, when fed in excess of requirements can be stored in the body and utilised later by the bird, the absence of it in the ration may not be felt for several months. Accordingly, we find various degrees of severity of this disease in single flocks, some only showing lack of vitality and

low production, whilst others may be dying of the most advanced form of the disease.

Vitamin A is found in practically all green succulent feeds, in well-cured lucerne and other green leaf meals, in yellow maize —but not in white maize—in skim-milk, yellow carrots, sprouted oats, eggs, tomatoes, spineless cactus, majordas and cod liver oil.

As will be seen from this list, it is very easy for the birds upon many Rhodesian farms to lack this essential vitamin during the dry months, especially just prior to the rains, if they are not being fed yellow maize, milk or dry green leaf meal. During this period if succulent green feed of some description cannot be fed it is essential to feed yellow maize and lucerne—or sunflower —leaf meal, about 10% of the latter in the mash. For those who desire to play absolutely safe, 1% cod liver oil in the mash will provide an adequate amount of this vitamin, when other sources are not available.

When possible give all birds all the green feed they will eat without causing looseness of the bowels or darkening of the egg yolks, that they may have the opportunity of storing this vitamin within their systems to help them through any later deficiency. Normally, provision should be made for 5-6 lbs. of succulent greens per 100 birds per day.

The leaves of many of the wild trees are eaten by poultry, and, during a shortage, any green feed of this kind available may be tried, provided it is not poisonous, by chopping it and adding it to a wet mash. All the infertile eggs from the incubators may also be fed to the chicks, without cooking, mixed with mash, if from bacilliary white diarrhoea-free tested stock.

No amount of syringing or other treatment will cure this disease, but very quick recovery is effected immediately the Vitamin A is supplied, unless so much vitality has been lost that the bird is not worth keeping in any case.

Vitamin B_2. This is a complex vitamin, also known as Vitamin G in the United States of America. The two factors which are of most importance in poultry diets are riboflavin and panthothenic acid, also known as the filtrate factor.

Riboflavin is the more important factor, a deficiency of which causes slow growth in chickens and in severe cases a characteristic paralysis of the legs known as "curled toe paralysis," in which the toes curl inwards and the chick suffles along on its hocks with the aid of its wings. The riboflavin requirement for optimum growth varies with the age of the chickens, and for the first eight weeks the riboflavin requirement is highest. This also applies to ducks and turkeys.

Riboflavin is also essential for good hatchability. It is necessary to a less extent for egg production, but a deficiency may cause a loss of 10% or more.

The best sources of riboflavin are pure dried yeast, liver meal, milk products, dried green meals, green feed. Where whey, skim-milk or buttermilk are available, there will be no riboflavin

deficiency. Dried green meals should always be included and succulent greens as well, but these alone cannot provide enough riboflavin, especially in the case of chicks and breeding hens. Therefore, in the absence of milk products 3% of dried brewer's yeast should be added to the mash when procurable.

Pantothenic acid is less likely to be deficient in ordinary rations as the requirements for all classes of stock is less than for riboflavin and it is found in cereal grains and their by-products. A deficiency of pantothenic acid causes ruffled feather growth and roughness of the skin round the beak and the eye-ring, between the toes and under the feet. The eyes become dull and remain half closed, and at the same time the growth of chicks is retarded, and hatchability is lowered in the case of breeding hens.

In young turkeys the symptoms of riboflavin deficiency are similar to those of pantothenic acid deficiency in chickens.

Pantothenic acid is found in pure dried yeast, liver meal, cane molasses, peanut cake meal, rice bran, whey, and, to a less extent, in other milk products, green leaf meals, bran and the cereal grains.

Riboflavin and pantothenic acid are stable vitamins and do not disappear from the mash if used within a reasonable time. As in the case of other vitamins, prolonged exposure to sunlight and dew in curing lucerne or other green hay for meal results in a loss of the riboflavin.

Vitamin D. Vitamin D is concerned in the use of calcium and phosphorus. Its absence from the ration causes the bones of young stock to fail to harden and a deficiency disease called rickets develops. This is frequently called leg weakness because of lameness and inability to stand. Vitamin D is necessary also for egg production and hatchability. Its presence in the ration helps to form strong-shelled eggs

Vitamin D is one of the most important of the vitamins for it is difficult to supply it in the feed.

Fortunately, the ultro-violet rays of sunlight are an effective substitute for Vitamin D, having the same effect upon the metabolism of calcium and phosphorus.

In Rhodesia, with all our sunshine, the want of Vitamin D is never experienced. Points to bear in mind, however, are that the ultra-violet rays will not pass through ordinary glass into the brooder-house, hence the use of substitutes such as "celoglass," which have been manufactured specially to allow these rays to pass through. Should we ever experience a more or less sunless rearing season, which is almost unthinkable, then probably we should have to feed 1% cod liver oil in the feed, especially to the growing stock, as it is the only feed with any appreciable amount of Vitamin D in it, with the exception of eggs and a little in lucerne, green and dry. It is the most important vitamin to be considered in the Northern Hemisphere. Ultra-violet light may be produced artificially, but to do so is more expensive and troublesome than feeding cod liver oil.

In view of the effect that either Vitamin D or sunlight has upon egg production, shell formation and hatchability, apart from growth, it will be seen how necessary it is, from this point of view alone, to allow our layers, breeders and growing chicks access to the sunshine, and what a cheap and pleasant form of substitute for Vitamin D we are blessed with in Southern Rhodesia! Vitamin D is stored in the body like Vitamin A.

Over-exposure to hot tropical sunshine where insufficient shade is provided will cause sunburn, resulting in poor feathering in chickens and moulting pens. It probably has a stunting effect on growing chickens. Therefore, whilst it is essential for all stock to have access to direct sunlight, it is also equally important in Rhodesia to provide adequate shade, preferably from trees.

Vitamin E. (alpha-tocopherol). A lack of this vitamin is not often encountered in ordinary feeds, but it has been shown that in cod liver oil there is a factor which hinders the utilisation of Vitamin E. So, where cod liver oil is being fed, there is more likely to be a deficiency.

Vitamin E deficiency is manifested in chickens during the 15th to 30th day of life by a droopiness and a desire to remain in a fixed posture. Nervous symptoms appear sometimes suddenly and they normally take the form of a lack of power to co-ordinate muscular movements, especially of the head. The legs may be retracted and relaxed rapidly, though complete paralysis of the legs and wings is not observed. Prostration is followed by death.

Vitamin E is not required for egg production, but is necessary for germ development, and hens fed on a deficient diet produce eggs of low hatchability.

Certain vegetable oils contain a substance which will prevent this condition. Among these are cottonseed oil, peanut oil and soya bean oil.

Where this condition of "crazy chick" disease, as it is sometimes called, occurs, give daily 2-3% of peanut oil in the diet until the symptoms disappear. In individual cases give 3-4 drops of the oil daily for 4-5 days.

Other vitamins are required by chickens, but, as they are not likely to be deficient in any of the normal rations, it is unnecessary to mention them here.

It is essential to provide for Vitamins A and B_2 (riboflavin and pantothenic acid) in all rations, and D in the form of direct sunshine.

HOW TO USE THE FEEDS.

Having discussed the various feeds for poultry in this country, the next step is for the farmer to know how to use them in order to produce the desired results. It must be emphasised here that there is no one best ration applicable to all farmers. The best ration for each individual farmer is that which produces the best results at the minimum cost of production on his farm.

Success in poultry feeding depends primarily upon—

1. The individual responsible for the feeding and his powers of observation. Native labour, unless well-trained and experienced, should not be relied upon for this most important work without frequent supervision.
2. The quality of the food supplied.
3. What is termed a "balanced" ration.
4. The environment, allowing the birds to make the best use of the supplied food.
5. The health, vigour and heredity of the stock.

Maintenance. Before egg production, growth or fat can be provided, the bare maintenance of the bird must be satisfied. About three-quarters of the food taken in is for this purpose and only a surplus goes to the production of eggs or flesh. Maintenance requirements are for heat, energy and repairs to the body tissues, etc. Where a ration is inadequate, growth or production and not maintenance is the first to suffer. Feeders of all classes of stock would do well to bear this fact in mind. No profit comes directly from the maintenance of the body, but unless it is satisfied no profit can be expected from the little extra which goes to form eggs or meat.

Definition of Terms. In order to understand how to furnish the feeds in the correct proportions it is necessary to know something about their composition and digestibility. This is supplied in the accompanying table and refers to the amount of digestible nutrients available in the various feeds as far as poultry are concerned.

A balanced ration is one that consists of the proper nutrients in the right amounts for the purposes intended

A nutrient is any constituent of a feed that produces heat or energy or builds body tissues.

Feeds are composed of water and dry matter, but not sufficient water for the body needs, therefore it must be supplied. Dry matter is composed of organic and inorganic substances. The organic matter is combustible and consists of sugars, starch, fat, protein and fibre. The inorganic substance is composed of minerals and ash.

The protein is chiefly concerned in the making of lean meat, nerves and feathers in the fowl and the albumen or white of the egg. It is essential for egg production and growth. No nutrient will take its place, and it is generally the most expensive part of the feed.

The source of the protein is of importance in balancing the cereal grains which make up for the most part the carbohydrates in the feed. However, it is not the protein that is of such importance but the amino-acids comprising it. A vegetable protein is no more and no less valuable than an animal protein carrying the same amino-acids. It has been shown that protein from vegetable sources carrying the correct amino-acids could partly or wholly replace animal protein in the ration when supplemented with minerals.

Therefore, whether vegetable protein supplements should be used partially to replace animal protein supplements will depend upon the relative prices of the digestible proteins. The emphasis as to the source of the protein should not be made as between animal and vegetable, but between grain and other sources.

Other factors, however, influence the selection of the protein supplement, and as supplements of animal origin such as milk products, meat and fish products, are more palatable and add variety to the ration, a proportion of one of them in the ration is usually recommended. As mentioned elsewhere the vegetable sources of protein carrying the desirable amino-acids in this country are chiefly peanut meals, soya bean meals or other legumes.

Carbohydrates include the fibre and nitrogen-free extract. The fibre is the woody or cellulose portion of plants. This the fowl can only digest to a minor degree, but a certain amount is necessary to distend the intestines and allow the digestive juices to act more thoroughly. Nitrogen-free extract consists mainly of the starches and sugars and is used by the fowl to supply heat and energy, any excess being stored as fat.

Fat has the same function as nitrogen-free extract, but is, however, more effective than starch and sugars and gives 2¼ times as much energy for each unit of weight. Digestible nutrient refers to the amount of any of the feed substances that can be assimilated by the class of stock concerned. Poultry differ somewhat from ruminants in their ability to digest these nutrients. The digestible co-efficient of any food nutrient can only be found by actual trial. However, a certain amount of work has been done with poultry in Europe and the U.S.A. and digestible co-efficients arrived at for the more important feeds. These have been used as far as possible, together with Rhodesian or South African analyses of feeds where available, in order to compile the "table of feeds." Where no co-efficients of digestibility are available those for a similar feed or those for other classes of stock have been taken and are as near as possible correct until more work is done on this important subject with poultry.

The nutritive ratio means the amount of digestible protein in the feed or ration as compared with the combined digestible carbohydrates and fat A nutritive ratio (N.R.) of 1 to 5 (or 1:5) means that the feed or ration contains one part of digestible protein to every five parts of digestible carbohydrates and fat.

The total digestible nutrient (T.D.N.) is found by multiplying the digestible fat in the feed by 2¼ and adding this to the digestible carbohydrates (or nitrogen-free extract), digestible proteins and digestible fibre, if any in the feed.

Standard Requirements. No very detailed standards of requirements are available for poultry as there are for other classes of farm animals, but from studying the results of successful

rations the following standard requirements are considered to be fairly accurate:—

Growing Chickens to 12 Weeks. Fibre 4-6% of total food consumed. Digestible proteins 18-20% of the total food consumed, of which 4-5% should be animal protein.

Total digestible nutriment 70-75%. Here the nutritive ratio is 1:3 to 1:4.

Laying Hens and Chickens after 12 Weeks of age. Fibre 4-6% of total food consumed. Digestible protein 12-15%, of which 3-4% should be animal protein.

Total digestible nutriment 70-75%. Here the nutritive ratio is 1:4 to 1:5.

Fattening Birds. Fibre 3-5% of total food consumed. Digestible protein 10-12%, of which 3-4% should be animal protein.

Total digestible nutriment 75-80%. Here the nutritive ratio is 1:6 to 1:7.

Rations should be compiled to conform as nearly as possible to the standard requirements as given. It must be emphasised that these requirements are a guide only and other feed factors must be considered before a ration which may conform to the requirements theoretically could be considered desirable. The feed factors to be considered further are—

Variety. A variety of feed is necessary to stimulate the appetite and increase the consumption, though sudden changes in feed are not desirable. Where nearly equal parts of grain and mash are fed a ration containing a good variety may be made up somewhat as follows:—

Grain, at least two kinds	40%
Ground feeds, at least three kinds	35%
Animal feeds, one kind usually desirable	5%
Green feeds, as large a variety as possible	15%
Minerals, grit and shell	5%

Palatability. Feeds that are not palatable to poultry must not be fed to any extent. At times they can be mixed with other feeds in the mash. Feeds that are unpalatable have been mentioned under the discussion of the feedstuffs.

Wholesomeness. Only sound, sweet feed should be utilised. Decayed or musty feeds may cause serious trouble.

Mechanical Condition. The feed must not be too bulky or the birds will not be able to consume sufficient. If the fibre requirements are adhered to the ration should be correct in this respect. Glutinous feeds must not form too large a percentage of the mash, as they become sticky when mixed with water or the digestive juices and are not readily consumed.

Medicinal Effect. Some feeds are laxative, notably the oil meals and wheaten bran.

Availability. Home-grown feeds should be used as far as possible; some which alone are not satisfactory may be combined with other feeds to form a desirable ration.

Cost. In all cases the best feed is the one which gives the most economical return, and all feeds should be considered from this viewpoint. Sickness and mortality due to improper diet must be reckoned against the cost of such diet.

Effect on Product. Some feeds taint the eggs or flesh of the birds; they should be avoided as far as possible. These feeds were mentioned previously.

Vitamins. Provision for the necessary vitamins in all rations is of the utmost importance and has been fully discussed previously.

Computing Rations. As an example the following laying ration has been worked out, using the table of feeds provided. Referring to the table it is seen that 100 lbs. of wheaten bran contains 9.5 lbs. of fibre, 11.5 lbs. of digestible protein and 39.8 lbs. of total digestible nutriment. In a similar fashion, each feed is worked out according to the amount in the ration.

When equal parts of grain and mash are fed the totals of 100 lbs. of each must be divided by two to find the amounts in 100 lbs. of the complete ration.

	Fibre	Digestible Protein	Total Digestible Nutriment (T.D.N.)
Mash Mixture:			
lbs.			
20 Wheaten Bran	1.9	2.3	7.96
23 Pollard	1.08	3.35	17.36
30 Maize Meal	0.69	2.07	23.67
10 Fish or Meat Meal	—	5.42	7,80
7 Lucerne Meal	2.1	0.71	1.17
5 Peanut Cake Meal	0.22	2.01	4.17
3 Ground Limestone	—	—	—
1 Bonemeal	—	0.22	0.29
1 Fine Salt	—	—	—
100 lbs. Mash	5.99	16.08	62.42
Grain Mixture:			
lbs.			
70 Crushed Maize	1.4	5.18	55.86
20 Munga (N'youti)	0.32	1.8	15.70
10 Sunflower Seed	2.79	1.35	7.43
100 lbs. Grain	4.51	8.33	78.99
200 lbs. Ration	10.50	24.41	141.41
100 lbs. Ration	5.25	12.2	70.7

Succulent green food, though it contains digestible nutrients, is not, as a rule, taken into consideration in these calculations.

This ration, then, has 5.25 lbs. of fibre, 12.2 lbs. of digestible protein and 70.7 lbs. of Total Digestible Nutriment for every 100 lbs. of feed.

The nutritive ratio is computed by subtracting the digestible protein from the Total Digestible Nutriment, thus: 70.7—12.2=58.5. This figure (58.5) therefore represents the digestible carbohydrates and fat. Dividing by the digestible protein (12.2) gives the nutritive ratio (4.7) of the ration, which is expressed as 1:4.7.

From the above it will be seen that this ration conforms closely to the standard requirements for laying hens given previously, and may therefore be accepted as theoretically correct. As it also possesses palatability, variety, vitamins, minerals and available feeds, it may be considered complete and a balanced ration for egg production, fed in conjunction with succulent green food and, of course, water, shell and grit. The ration would be improved by using milk products to replace some of the meat meal or by the addition of 3% dried yeast.

If, in calculating the ration, the nutritive ratio is found to be too wide for the purpose, that is to say, it contains more carbohydrates and fat to each part of protein than desirable, the amounts of one or more feeds that have wide nutritive ratios should be reduced and one or more feeds that have narrow ratios (containing a large proportion of protein) should be substituted. If, on the other hand, the nutritive ratio is found to be too narrow, that is, containing less carbohydrates and fat to each part of protein than desirable, the amount of one or more feeds having narrow nutritive ratios should be reduced and one or more feeds having wider nutritive ratios should be substituted. In this way, after a few trials, it should be possible to form a ration that will contain all the food nutrients in proper proportion and amounts for the particular class of stock to be fed.

There are various methods of feeding poultry, but the most popular system is to give free access to the dry mash in waste-proof feeders, allowing at least 20 feet of space per 100 hens, and to feed the grain in scratching litter by hand in the late afternoon at the rate of 1½ ozs. per bird or 10-12 lbs. per 100 birds, per day. This method lends itself well to alteration to suit circumstances, as wet mash may be fed in addition, if desired, or the grain may be fed in two feeds.

Most green food should be chopped and fed in troughs or wire baskets once or twice daily, giving 5-6 lbs. per 100 birds daily.

Oyster shell or limestone grit and clean, cool water should be available to the birds at all times.

Chickens should be fed an 18-20% protein all mash ration until 8 weeks of age, when grain feeding may commence. Give increasing quantities of grain until at maturity equal quantities of grain and mash are being fed.

Table of Feeds showing the Average Digestible Composition per 100 lbs, of Feed for Poultry.

Feed	Total Crude Fibre lbs.	Digestible Crude Protein lbs.	Total Digestible Nutriment lbs.	Nutritive Ratio 1 :
Barley	4.6	8.7	71.0	7.16
Bean Meal	9.4	20.5	75.6	2.9
Buckwheat	10.1	6.1	63.4	9.39
Buckwheat Middlings	4.8	24.6	75.0	2.0
Cassava	3.0	1.1	78.6	70.5
Cottonseed Meal	11.5	27.6	67.5	1.45
Coconut or Copra Meal	13.6	14.2	81.1	4.7
Cowpeas	4.1	19.4	76.4	2.9
Gluten Feed	7.1	21.6	75.4	2.5
Hominy Feed	8.5	6.3	76.5	11.1
Kaffir Corn	2.3	7.6	76.6	9.09
Maize, Whole	1.8	8.4	80.6	8.6
Maize, Cracked	2.0	7.4	79.8	9.78
Maize Meal	2.3	6.9	78.9	10.43
Maize and Cob Meal (Corn and Cob)	8.5	6.3	76.5	11.1
Maize Germ Meal	2.0	9.1	88.2	9.2
Millet, Pearl (N'youti or Munga)	1.6	9.0	78.5	7.7
Milo	2.4	8.7	79.9	8.2
Oats	10.1	9.8	62.9	5.42
Oatmeal	9.9	9.0	58.1	5.5
Palm Kernel Meal	13.4	13.2	77.6	4.8
Pea, Field	5.6	20.2	90.5	3.48
Peanut Meal with Shell (not extracted)	12.5	17.1	93.6	4.47
Peanut Meal (Kernels)	2.5	29.4	133.9	3.5
Peanut Meal, extracted (Shelled Nuts)	4.5	40.3	83.5	1.1
Pollard	4.7	14.6	75.5	4.0
Rice	9.6	5.7	62.0	9.88
Rice Bran	12.4	7.9	65.8	7.3
Soya Bean Meal (not extracted)	4.3	33.2	94.1	1.8
Soya Bean Meal (extracted)	5.5	34.7	72.5	1.09
Sunflower Seeds	27.9	13.5	74.3	4.5
Sunflower Head Meal (no seeds)	14.19	6.86	60.4	7.4
Sunflower Head Meal (with seeds)	20.52	10.25	72.96	6.3
Wheat	2.2	8.7	73.5	7.45
Wheat Bran	9.5	11.5	39.8	2.46
Wheat Feed	7.6	12.9	64.2	4.0
Wheat Screenings	7.4	9.6	62.3	5.5
Blood Meal	—	72.6	76.8	0.06
Blood (Dried or Fresh)	—	62.10	97.07	0.5
Bone Meal	—	22.6	29.4 *	0.3
Bone, Fresh Cut	—	18.3	73.4	3.0
Buttermilk	—	3.4	8.4	1.5

Feed	Total Crude Fibre lbs.	Digestible Crude Protein lbs.	Total Digestible Nutriment lbs.	Nutritive Ratio 1 :
Crayfish Meal	—	36.0	62.4	0.6
Fish Meal	—	56.1	72.6	0.4
Locust Meal	10.81	44.47	93.9	1.0
Meat Meal (High grade)	—	54.2	78.0	0.44
Meat Meal (50% Protein)	—	46.2	70.0	0.5
Meat and Bone Meal	2.1	36.6	64.2	0.7
Meat, Fresh	—	18.5	26.6	0.4
Meat, Dried	—	60.2	92.3	0.4
Milk, Separated...	—	3.6	9.2	1.6
Whey	—	0.8	6.2	7.8
Succulent Green Feeds, Roots, etc.				
Cabbage	0.9	1.9	7.1	2.7
Cactus, Spineless	2.3	0.4	9.7	23.2
Canna, edible (plant)	1.6	2.1	4.5	1.1
Carrots	1.2	1.9	7.2	2.5
Lucerne	7.0	3.3	11.7	2.5
Mangels	0.8	0.8	6.7	7.4
Melon, Cattle (Majorda)	1.4	0.3	4.8	15.0
Oats, Green ... ... · ·	1.7	3.4	7.5	1.2
Oats, Sprouts	3.7	2.4	15.8	5.6
Potato	0.4	1.0	15.7	14.7
Pumpkin	1.3	1.1	6.7	5.1
Rape ... ... ·	2.6	2.6	11.0	3.2
Sunflower Leaf	1.97	3.12	14.2	3.4
Swiss Chard or Spinach Beet ...	2.9	3.1	7.1	1.2
Dry Leaf Meals.				
Lucerne Meal	30.1	10.2	16.8	0.6
Sunflower Leaf Meal...	7.8	12.5	26.6	1.2

Rhodesian Milk Records

OFFICIAL MILK RECORDS.

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
Mitchlin Dignity E (Recalved 2.5.48)	P.B. Friesland	Mature	12924.00	432.58	3.35	300	W. S. Mitchell, Springs Farm, Iron Mine Hill.
Mitchlin Liberty (Recalved 28.3.48)	P.B. Friesland	Mature	8682 00	314.51	3.62	300	
Mitchlin Lily's Countess (Recalved 23.3.48)	P.B. Friesland	Mature	8037.00	295.44	3.68	300	
Matopo Utopia	Red Poll	Jun. 4 years	6368.90	222.23	3.49	300	Government Experiment Station, P.B. 19K, Bulawayo.
Matopo Quaint	Red Poll	Mature	7323.30	289.57	3.95	300	
Matopo Umsasa	Red Poll	Jun. 4 years	5582.20	229.09	3.92	300	
Matopo Treasure	Red Poll	Mature	14410.90	478.25	3.25	300	
Matopo Unique	Red Poll	Jun. 4 years	13445.00	421.37	3 13	300	
Dewdrops Gipsy of Wanganella	Guernsey	Mature	5020.50	231.93	4.62	300	E. J. Hards, Churchill Farm, Marandellas.
Lilac's Cherry of Wanganella	Guernsey	Jun. 4 years	4153.00	212 07	5.11	300	
Beauty's Harmony of Wanganella	Guernsey	Sen. 4 years	4002.50	230 54	5.75	300	
Gipsy's Heather of Wanganella	Guernsey	Sen. 3 years	4577.00	274 21	5.99	300	
Molly's Gem of Wanganella	Guernsey	2 years	5479.50	247 14	4.51	300	
Herrenhausen Pat	Jersey	Jun. 3 years	4078.00	229.54	5.63	240	J. H. Keightley, Moorfields, Glendale.
Katinka Nancy	Jersey	2 years	3882 50	199.65	5 14	240	
Meadows Ophelia	Jersey	Jun. 4 years	5079.50	311.25	6.13	300	
Checkmates Glow-worm	Jersey	Sen. 4 years	4160.50	227.65	5.47	289	
Albert Vale Marion Van N.6/331 (Recalved 27.6.48)	Friesland	Sen. 4 years	7684.00	265 93	3.46	281	T. C. Pascoe, Crowborough Estate, P.O. Box 1253, Salisbury.
Albert Vale Slangisa XI (Recalved 14.5.48)	Friesland	Mature	7548.00	274.99	3 64	294	
Albert Vale Andre (Recalved 31.3.48)	Friesland	Mature	8107.50	317 87	3 92	300	

Albert Vale Spinnekop (Recalved 16.6.48)	Friesland	Sen. 3 years	5394.50	207 83	3.85	300	T. C. Pascoe, Crowborough Estate, P.O. Box 1253, Salisbury.
Crowborough Clara (Recalved 16.5.48)	Friesland	2 years	7297 50	256 08	3 51	300	
Crowborough Sadie	Friesland	Sen 3 years	3980.00	134.20	3.37	291	
Albert Vale Bokwagen (Recalved 19.9.48)	Friesland	Sen. 4 years	6833.00	222 29	3 25	300	
Meadows Sunshine's Dawn III	Jersey	2 years	6222 00	323 50	5 20	300	Mrs D L Rodger, Inverleith Park, P O Box 488, Bulawayo.
Vrederust Star Domino	Jersey	2 years	6481.00	329.13	5.08	300	
Vrederust Redwing	Jersey	Sen 3 years	6597.50	324 82	4 92	300	
Schoongezicht Lonely	Jersey	2 years	6883.50	290.90	4.23	300	
Schoongezicht Shasta	Jersey	18 months	4316 50	230 59	5 34	300	
Whinburn Sage (Recalved 30.4.48)	Friesland	Mature	9287 50	317 25	3 42	300	Major R R Sharp, Whinburn, Redbank, Bulawayo.
Whinburn Amber (Recalved 7.5.48)	Friesland	Sen 3 years	9848 40	338 62	3 44	300	
Whinburn Fatima (Recalved 22.3.48)	Friesland	Mature	9344.00	306.98	3 29	300	
Whinburn Lark (Recalved 3.4.48)	Friesland	Jun. 4 years	8314 80	263 79	3 17	300	
Whinburn Gavotte (Reca'ved 9 6.48)	Friesland	Mature	9587.40	309 58	3.23	300	
Whinburn Candy (Recalved 11.4.48)	Friesland	Mature	11469 70	395 76	3 45	300	
Whinburn Aconite (Recalved 22.6.48)	Friesland	Sen 3 years	8710.00	297 10	3 41	300	
Whinburn Barley (Recalved 8.5.48)	Friesland	2 years	5497 10	224 73	4 09	300	
Whinburn Clover (Recalved 19.5.48)	Friesland	2 years	6439 80	233 12	3 62	300	
Whinburn Amulet (Recalved 7.4.48)	Friesland	Jun. 4 years	7604 80	270 23	3 55	300	
Whinburn Bluster (Recalved 7.6.48)	Friesland	2 years	5519 20	203.90	8 69	300	
Whinburn Puffin (Reca'ved 4.7.48)	Friesland	Mature	10535 00	373.84	3.55	300	
Whinburn Blossom (Recalved 4.5.48)	Friesland	2 years	6358 60	226.45	3.56	300	
Whinburn Answer (Recalved 12 7.48)	Friesland	Sen. 3 years	10427.20	362 72	3.48	300	
Whinburn Balm (Recalved 28.8.48)	Friesland	Mature	9410.40	350 91	3.73	300	
Mitchlin Prudence A (Recalved 20.6.48)	Friesland	Mature	9540.50	285.13	2.99	300	Lt.-Col. F. H. Stead, Arizona, P.O. Box 56, Gwelo.
Mitchlin Patricia (Recalved 5.6.48)	Friesland	Sen. 4 years	7088.00	327.28	3.21	300	
Mitchlin Dignity D	Friesland	Mature	9267.00	244.78	2.64	300	

SEMI-OFFICIAL MILK RECORDS

Name of Cow.	*Breed.*	*Age.*	*Milk in lbs.*	*B. Fat in lbs.*	*Average % B. Fat.*	*No. of Days.*	*Name and Address of Owner.*
Banzi	G. Friesland	Mature	6806.70	266.14	3.91	300	D. A. Allan, Pendennis, P.O. Avondale.
Chikumbo	G. Friesland	Mature	8314.90	272.24	3.27	300	
Jessie	G. Friesland	Mature	8316.50	307.99	3.70	300	
Sirenga	G. Friesland	Mature	6659.00	238.20	3.58	239	
Blanche	G. Friesland	3 years	7360.60	240.55	3.27	300	Mrs. M. Allan, Pendennis, P.O. Avondale.
Girlie	G. Friesland	3 years	7911.90	292.76	3.70	300	
Mabel	G. Friesland	3 years	8529.80	297.17	3.48	300	
No. 41	G. Friesland	Mature	7934.50	244 67	3.08	300	G. R. Anderson, Warrender Farm, Box 8, Gwelo.
No. 51	G. Friesland	Mature	6787.90	248.64	3.65	300	
Annetta II C	P.B. Friesland	Mature	7995.10	270.04	3.38	293	
No. 20	G. Friesland	Mature	7171.90	270.12	3.77	300	
Daisy	G. Friesland	3 years	7077.20	225.76	3.19	300	I. D. H. Anderson, Upcott Farm, P.O. Fort Victoria.
Stockings	G. Friesland	Mature	9037.20	315.38	3.49	283	
Castor Oil	G. Friesland	Mature	7392.00	270.77	3.66	300	R. A. Ballantyne, P.O. Box 801, Salisbury.
Delilah	G. Friesland	4 years	5064.00	226.99	4.48	300	
Edinburgh	G. Friesland	3 years	7596 00	236.89	3.12	300	
No. 104	G. Friesland	Mature	6517.00	230 32	3.53	265	
Vumba	G. Friesland	Mature	7035.00	244.69	3 48	300	
Barbara	G. Friesland	3 years	5557.50	225 59	4.06	300	N. G. Barrett, Gavenny, P.O. Box 38, Rusape.
Melda	G Friesland	4 years	5652.50	230 46	4 08	300	
Jo'burg	P.B. Friesland	Mature	6730.20	228.10	3.39	300	F. Barry, Umtassa, Box 2019, Umtali.
Molly II	G. Shorthorn	Mature	5506.20	261.77	4.75	300	
Umtassa Arbrook Fancy	P.B. Shorthorn	3 years	6447.50	290.70	4.51	300	
Umtassa Arbrook Primrose	P.B. Shorthorn	3 years	5688.00	254.61	4 48	300	
Daisy	G. Shorthorn	20 months	7445.40	290.28	3 89	300	
Daisy	G. Friesland	Mature	6977 00	297.92	4.27	300	Col. G. Barry, P.B. 161R, Bulawayo.
Pansy	G. Red Poll	Mature	5957.00	243.57	4.09	300	

Carlie II	G. Shorthorn	4 years	5208.60	239.93	4 61	300	J H. Barry, Enavant, P.B. Umtali.
Charter III	G. Shorthorn	Mature	6539.90	282.55	4.32	300	
Dinah	G. Shorthorn	3 years	6096.30	259.73	4.26	300	
Mary	G. Shorthorn	Mature	6861.10	322.61	4.70	300	
Bats	G. Friesland	Mature	6404.50	260.21	4.06	280	J. A Baxter, Glen Norah, Box 1368, Salisbury.
Billions	G. Friesland	Mature	7299.90	273 93	3.75	300	
D. 2 Fighter	G. Friesland	Mature	6686.30	269 53	4 03	275	
Glover	G. Friesland	Mature	6821.30	249.98	3 66	255	
Home	G. Friesland	4 years	7123.60	263.28	3 70	290	
Jessie	G. Friesland	Mature	8484.10	308.77	3.64	300	
Potsdam	G. Friesland	Mature	7767.90	281 19	3.62	300	
Sixpence	G. Friesland	4 years	6518.70	253.36	3.89	300	
Sophia	G. Friesland	Mature	8611.50	263 14	3.06	300	
Window	G. Friesland	Mature	8681 20	321.20	3.70	300	
Winston C.	G. Friesland	Mature	6871.60	285 12	4.15	300	
Albert Vale Bokwagen Van 6/387	P.B. Friesland	3 years	6813.90	288.23	4 23	300	
Albert Vale Rosa Van 6/386	P B. Friesland	3 years	7028.00	230 09	3.27	300	
Albert Vale Umpoekoe Van 6/390	P.B. Friesland	3 years	7086.90	260 94	3 68	300	
Billy Boy D. 100	G. Friesland	Mature	8637 80	271 04	3 14	300	
Clacupar Phils Hectory	P.B. Friesland	2 years	7360.10	306 96	4 17	300	
Dongera	G. Friesland	Mature	6709.20	250.59	3 74	282	
Iron	G. Friesland	Mature	9258.80	283.03	3.06	300	
Joseph	G. Friesland	Mature	6726.00	293.96	4 31	300	
War	G. Friesland	Mature	6372 10	248 62	3.90	300	
D.5	G. Friesland	Mature	11127.40	410.79	3.69	300	A. L. Bickle, Box 595, Bulawayo.
D.57	G. Friesland	Mature	8042.10	259.97	'3 23	245	
D.72	G. Friesland	Mature	10649.80	339.09	3 18	300	
D 73	G Friesland	Mature	8560 70	316.74	3.70	240	
D.83	G. Friesland	Mature	11311.80	359.46	3.18	289	
D.85	G. Friesland	Mature	11182.20	435.77	3.80	300	
D.90	G Friesland	Mature	9302.10	330.87	3.56	260	
D.99	G. Friesland	Mature	12264 90	394 87	3.22	300	
D.120	G. Friesland	Mature	7353.50	260.59	3.54	276	
D.127	G. Friesland	4 years	10682 10	404.75	3.79	300	
D.135	G. Friesland	4 years	11583.40	399 77	3.45	300	
D.149	G. Friesland	4 years	9979.60	366.03	3.67	300	

SEMI-OFFICIAL—(Continued).

Name of Cow	*Breed.*	*Age*	*Milk in lbs.*	*B Fat in lbs.*	*Average % B. Fat.*	*No. of Days.*	*Name and Address of Owner.*
D.172	G. Friesland	3 years	10386.70	315.77	3.04	255	A. L. Bickle, P.O. Box 595, Bulawayo.
J.58	G. Friesland	Mature	13322.00	472.49	3.55	300	
J.59	G. Friesland	Mature	10953.00	488.16	4.46	300	
D.84	G. Friesland	Mature	8081.50	332.34	4.11	260	
D.102	G. Friesland	Mature	8946.40	298.23	3 33	265	
D.143	G. Friesland	4 years	8456.70	256.68	3.04	300	
D.164	G. Friesland	4 years	7382.30	266.14	3 61	274	
D.177	G. Friesland	5 years	7853.90	280.03	3.69	300	
D.194	G. Friesland	3 years	6997.50	230.73	3.30	283	
J.67	G. Friesland	Mature	9953.10	342.39	3.44	300	
J.70	G. Friesland	Mature	7798.70	288.11	3.69	300	
Helenvale June	P.B. Friesland	2 years	8912.80	325.16	3.65	293	
Sly I	G. Afrikander	3 years	9350.70	364.93	3.90	296	
Bessie I	G. Friesland	Mature	6600.20	244.95	3.71	300	Mrs. M. Black, Burnside, P.O. Bindura.
Donser I	G. Friesland	Mature	6803.30	225.37	3.31	300	
Katie II	G. Friesland	Mature	6844.00	229.86	3 36	300	
Jutice I	G. Friesland	Mature	7777.40	286 28	3.68	300	
Blacktop	G. Friesland	Mature	6925 50	228.47	3 30	300	W. P. Bonett, P.B. 170R, Bulawayo.
No. 2	G. Red Poll	Mature	6120.00	251.24	4 10	300	P. A. Bowen, P.O. Box 893, Salisbury.
No. 21	G. Red Poll	Mature	5756.00	225 56	3 91	273	
No. 69	G. Shorthorn	Mature	5866.00	249.30	4.25	260	
No. 100	G. Red Poll	Mature	5591.00	232.54	4.16	300	
No. 287	G. Friesland	3 years	6308.00	240.73	3.82	300	C. Boyd Clark. Mount Zonga, Inyazura.
No. 135	G. Friesland	Mature	8377.00	339.68	4.05	295	
No. 195	G. Friesland	Mature	8404.00	316.01	3.76	300	
No. 249	G. Friesland	Mature	6876 00	248.06	3.61	297	
No. 317	G. Friesland	3 years	6594.00	243.69	3.70	300	
No. 319	G. Friesland	3 years	7592.00	294.46	3.88	300	
Grove Park Julia	G. Friesland	Mature	8355 50	330.38	3.96	300	Bradley Bros., P.O. Box 699, Bulawayo.
Grove Park Red	G. Shorthorn	Mature	6834.00	256.11	3.75	300	

Peacekop	G. Guernsey	Mature	7586.90	247.68	3 26	270	Miss N Brereton, Coolmoreen, Gwelo.
Annetta	G. Friesland	Mature	6476.50	258.84	4.00	300	
Clara	G. Guernsey	Mature	5515 50	245.29	4.45	300	
Mshopi	G. Friesland	Mature	5838.90	232.72	3.93	300	
Wanda	G. Friesland	4 years	5874.50	238.74	4.07	300	
No. 22	G. Friesland	Mature	5606.30	237.45	4.24	276	Col. P. A. Brooke, Borrowdale, Homestead, P O. Box 1690.
Isobel	G. Friesland	Mature	9169.00	300.94	3.28	297	M. W. Burras, Hertford Farm, Box 443, Bulawayo.
Smarty	G. Friesland	Mature	10430.50	335.66	3.22	300	
Susan	G. Shorthorn	Mature	9791.00	337 80	3.45	300	
Blackie	P.B. Friesland	Mature	8200.00	373 57	4.56	300	E. Butler, Woodlands, P O. Shamva.
Patches	G. Ayrshire	2 years	6671.50	235.93	3.54	300	L. E. O. Cary, Clovelly, P.O. Trelawney.
Tania	G. Ayrshire	Mature	5325.50	234.38	4.40	300	
Tinsel	G Ayrshire	3 years	5862.50	233.40	3.98	300	
Edna	G. Ayrshire	3 years	5964.50	229.16	3.84	300	
Jupiter	G. Ayrshire	3 years	6315.50	305.05	4.83	300	
Maisie	G. Ayrshire	2 years	6637 50	232.95	3.52	300	
Clemence	G. Friesland	Mature	8020.90	305 73	3.76	300	R. Jackson Clarke, Box 98, Gwelo.
Poem	G. Friesland	Mature	8205.10	269.65	3 29	300	
Patricia	G. Friesland	Mature	6672.60	259 10	3 88	300	
Greta	G Friesland	Mature	6892 00	253.36	3.41	295	Cross & Son, Valindre, Box 953, Bulawayo.
Blinkers	G. Friesland	Mature	6013.00	248 01	4 12	260	
Clover	G Friesland	4 years	7838.00	249.11	3 19	300	
Springbok	G. Friesland	Mature	5499 00	244.18	4 44	279	
Surprise	G. Friesland	Mature	9446.00	366.88	3 88	292	
Esnati I	G. Friesland	Mature	8688.00	324.57	3 74	300	J. Cumming, Hillside Farm, P.O. Norton.
Esinati Leon	G. Friesland	Mature	7466.00	244.86	3.28	300	
Gwelo	G. Friesland	Mature	5856 00	241 04	4.12	300	
Kooi	G Friesland	Mature	6696 00	278 41	4.16	300	
Maria Scutt	G. Friesland	Mature	7958.00	246.20	3.09	300	
N'nyati	G. Friesland	Mature	7568.00	311.10	4 11	300	
Rusapi II	G Friesland	2 years	6672.00	280.53	4.20	300	
Wyte	G Friesland	Mature	6219.00	244.41	3 93	300	
Areuben II	G. Friesland	Mature	6764 00	290.23	4.29	300	
Gadzema	G Friesland	Mature	7718 00	237.40	3.08	300	
Isaki	G. Friesland	Mature	5569.00	236.56	4 25	300	
Jumbo	G. Friesland	Mature	5028 00	240 69	4 79	300	
Rhodesia	G. Friesland	Mature	5324.00	234.13	4 40	300	

SEMI-OFFICIAL—(Continued).

Name of Cow.	*Breed.*	*Age.*	*Milk in lbs.*	*B. Fat in lbs.*	*Average % B. Fat.*	*No. of Days.*	*Name and Address of Owner.*
Angelier	G. Friesland	Mature	7606.30	297.62	3.91	293	Daisyfield Orphanage, P.B. 151Q, Bulawayo.
Cups	G. Friesland	Mature	7293.00	271.15	3.70	300	
Liefling	G. Friesland	Mature	9264.00	300.60	3 24	300	
Maphosa	G. Friesland	Mature	7823.80	373.05	4.77	300	
Poppie	G. Friesland	Mature	7092.70	254.18	3.58	275	
Witmuis	G. Friesland	Mature	6737.40	243.80	3.62	284	
Blackie	G. Friesland	3 years	6355.10	246.69	3.88	300	A. B. Dobson, Endeavour Farm, Norton.
Gradier	G. Friesland	4 years	6365.00	227.58	3.58	300	
Sinola	G. Friesland	Mature	6804.80	257.93	3.79	300	
A.123	G. Friesland	Mature	5730.70	229.41	4.00	300	J. B. Dold, Box 1153, Salisbury.
No. 155	G. Friesland	Mature	7165.70	257.42	3.60	300	
No. 14	G. Friesland	3 years	5735.40	243.34	4.24	267	
Angel	G. Friesland	3 years	9474.50	306.23	3.23	300	D. M. Edwards, Box 11, Eiffel Flats.
Blackie	G. Friesland	3 years	7685.50	308.33	4.01	300	
Chick	G. Friesland	Mature	10934.10	407.24	3.72	260	
Jean	G. Friesland	3 years	7079.30	266.31	3.34	268	
Pam	G. Friesland	3 years	6703.70	244.30	3.64	253	
Nyati	G. Friesland	Mature	8190.10	304.84	3.72	246	
Que Que	G. Friesland	Mature	10663.10	395.28	3.71	300	
Sally	G. Friesland	Mature	7682.50	327.15	4.26	265	
No. 1	G. Friesland	Mature	10143.00	350.30	3.45	300	
Royal Lady	G. Friesland	2 years	7130.70	306.50	4.30	300	R. I. Edwards, Box 25, Chipinga.
Zonga de Grendel	P.B. Friesland	Mature	6637.00	256.30	3.86	271	Mrs. M. Everard, Castle Zonga, Inyazura.
Zonga Queen VIII	P.B. Friesland	3 years	6387.00	236.35	3.70	296	
No. 316	G. Friesland	3 years	5821.00	244.14	4.19	289	
No. 318	G. Friesland	3 years	6038.00	226.36	3.75	275	
No. 230	G. Friesland	Mature	6675.00	227.90	3.41	288	
No. 275	G. Friesland	4 years	6279.00	238.38	3.80	295	
No. 305	G. Friesland	3 years	5896.00	226.73	3.85	291	
No. 272	G. Friesland	4 years	6377.00	274.17	4.30	300	
Betty	G. Friesland	Mature	7995.00	309.29	3.87	300	

No. 157	G. Friesland	2 years	6286.00	225.33	3.58	300	H. C. Fischer, Olivia Farm, Headlands.
No. 204	G. Friesland	Mature	9986 00	347.60	3.48	290	
No. 290	G. Friesland	Mature	7250.00	269.05	3.71	256	
No. 292	G. Friesland	Mature	8862.00	353.84	3 99	300	
No. 26	G. Friesland	Mature	8218.50	320.97	3.91	300	
No. 113	G. Friesland	3 years	6154.00	251.66	4.09	300	
No. 33	G. Friesland	Mature	6167.50	229.64	3 72	266	
No. 59	G. Friesland	Mature	7658.50	284.00	3.71	255	
No. 278	G. Friesland	Mature	6595.50	253.97	3.86	197	
No. 64	G. Friesland	Mature	10743.00	341.60	3.18	293	R. Le S. Fischer, Wakefield, P.O. Headlands.
No. 75	G. Friesland	Mature	10020.00	385.60	3.85	300	
No. 88	G. Friesland	4 years	7704.00	327.92	4.26	300	
No. 93	G. Friesland	4 years	14998.00	461.33	3.08	300	
No. 102	G. Friesland	4 years	10140.00	354.87	3.50	293	
No. 201	G. Friesland	Mature	11766.00	387.45	3 29	300	
No. 227	G. Friesland	2 years	8827.00	305.95	3.47	300	
No. 228	G. Friesland	2 years	7406.00	283.26	3 82	279	
No. 30	G. Friesland	Mature	10490.00	391 59	3.73	300	
No. 34	G. Friesland	Mature	12947.00	434.48	3 36	300	
No. 45	G. Friesland	Mature	10909.00	382.95	3.51	300	
No. 49	G. Friesland	Mature	8328.00	268.85	3.23	285	
No. 54	G. Friesland	Mature	6943.00	242.77	3 50	291	
No. 55	G. Friesland	Mature	9680.00	337.85	3 49	282	
No. 80	G. Friesland	Mature	11129.00	361.17	3.25	300	
No. 161	G. Friesland	Mature	9653.00	311.92	3 23	260	
No. 204	G. Friesland	3 years	7624.00	273.06	3.58	300	
No. 208	G. Friesland	3 years	10075.00	395.68	3.93	300	
No. 211	G. Friesland	3 years	6939 00	295.75	4.26	300	
No. 237	G. Friesland	2 years	8082.00	282.89	3 50	300	
No. 240	G. Friesland	2 years	8305.00	340 63	4 10	300	
No. 35	G Friesland	Mature	10260.00	349.68	3.41	256	
No. 112	G. Friesland	4 years	8006.00	284.86	3.56	245	
No. 229	G. Friesland	2 years	6357.00	263.04	4.14	300	
No. 304	G. Friesland	Mature	6362 00	231.07	3 63	249	W F Fischer, Coldstream Dairy, Headlands.
No. 325	G. Friesland	Mature	7350.00	258.95	3.52	277	
No. 356	G. Friesland	Mature	7940.00	331 92	4.18	279	
No. 377	G. Friesland	Mature	8359.00	326.85	3 91	300	
No. 384	G. Friesland	Mature	7194 00	267 96	3 73	300	
No. 387	G. Friesland	Mature	6120.00	295.83	4.83	293	
No. 412	G. Friesland	3 years	6785.00	277.00	4.08	290	
No. 418	G. Friesland	2 years	5869.00	251.53	4 29	290	
No. 419	G. Friesland	3 years	6830 00	270.04	3 95	300	
No. 428	G. Friesland	Mature	6143 00	264.12	4 30	288	

SEMI-OFFICIAL—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
No. 444	G. Friesland	Mature	6456.00	249.09	3.86	300	W. F. Fischer, Coldstream Dairy, Headlands.
No. 450	G. Friesland	Mature	7658.00	343.15	4.48	300	
No. 470	G. Friesland	Mature	5947.00	277.27	4.66	279	
No. 475	G. Friesland	2 years	4815.00	227.64	4.73	280	
No. 480	G. Friesland	Mature	6122.00	266.64	4 36	288	
No. 496	G. Friesland	Mature	6873.00	259.42	3.77	300	
No. 537	G. Friesland	4 years	6227.00	233.40	3.75	300	
No. 228	G. Friesland	Mature	6556.00	238.67	3.64	300	
No. 352	G. Friesland	Mature	6000 00	240.69	4.01	240	
No. 392	G. Friesland	Mature	7235.00	303.29	4.19	281	
No. 403	G. Friesland	Mature	8500.00	295.27	3.47	272	
No. 435	G. Friesland	Mature	6873.00	267.72	3.90	238	
No. 441	G. Friesland	Mature	6154.00	247 68	4.02	300	
No. 452	G. Friesland	Mature	6613.00	273.64	4.14	300	
No. 454	G. Friesland	Mature	5813.00	260.65	4.48	293	
No. 458	G. Friesland	Mature	5997.00	247.36	4.12	223	
No. 463	G. Friesland	3 years	6084.00	268.31	4.41	300	
No. 500	G. Friesland	Mature	7173.00	276.56	3.86	278	
No. 502	G. Friesland	Mature	6581.00	260.52	3.96	300	
No. 533	G. Friesland	4 years	7251.00	254.85	3.51	300	
No. 561	G. Friesland	3 years	6610.00	268.59	4.06	299	
No. 569	G. Friesland	3 years	6995.00	295.38	4.22	300	
No. 586	G. Friesland	2 years	5498.00	233.24	4 24	283	
Gilston Constance	P.B. Red Poll	Mature	5932.70	247.89	4.18	300	G. N. Fleming, Gilston Estate, Box 688, Salisbury.
Gilston Greta	G. Red Poll	Mature	5358.90	226.22	4.22	300	
Jemaima	G. Friesland	Mature	8404.00	271.99	3.24	288	F. W. Forrester, Wilton, Marandellas.
Josefine	G. Friesland	Mature	7997 00	315.80	3 95	285	
Bunty	G. Friesland	Mature	7880.00	278.93	3.54	300	
Marzipane	G. Friesland	Mature	7204 00	286.92	3.98	300	
Kingston	G. Friesland	Mature	9698 90	491.02	5.06	300	G. J. Franklin & Son, Box 105, Umtali.
Mitzi	G. Guernsey	Mature	5013.70	257.13	5.29	300	
Nanny	G. Friesland	3 years	8673.30	364.76	4.21	300	
Nutmeg	G. Friesland	Mature	11269.20	535.07	4.75	300	
Poppy	G. Friesland	Mature	9186 50	403.47	4 39	300	
Popsy	G. Friesland	3 years	7385.60	306.24	4.15	286	

Priscilla	G. Friesland	3 years	6592.90	266.16	4 04	300	G J. Franklin & Son, Box 105, Umtali.
Sophie	G. Friesland	2 years	6969.50	265 68	3.80	300	
Stack	G. Friesland	3 years	6665.30	295.30	4.43	300	
Ada	G. Shorthorn	Mature	6010.00	246.64	4 10	300	
Beulah	G. Friesland	Mature	7506.60	299 79	3.99	300	
Blue Bell	G. Friesland	3 years	5669.30	258.60	4.56	300	
Business	G. Friesland	Mature	7569 00	274.16	3.62	300	
Fourpence	G. Friesland	2 years	5935.30	234 97	3 95	300	
Ganganda I	G. Guernsey	Mature	8022.30	396 14	4 94	300	
Hopbeer	G. Friesland	Mature	10696.00	453 19	4.24	300	
Johannesburg	G. Friesland	4 years	6100 10	268 64	4.40	300	
Marion	G. Guernsey	2 years	4387.90	237 94	5 42	275	
M'Dondo	G. Friesland	Mature	8792 80	316 21	3.60	300	
Mhaka II	G. Friesland	3 years	6733.80	286 55	4 26	300	
Mimi	G. Friesland	Mature	13891.90	544 08	3.92	300	
M'Sorro	G. Friesland	Mature	9762.10	393.38	4 03	300	
Nelly	G. Friesland	3 years	7145 00	337 52	4.72	289	
N'Dongwe	G. Friesland	Mature	7594.60	328 17	4 06	300	
Patsy	G. Shorthorn	4 years	7335 60	325 49	4.44	300	
White I	G. Friesland	Mature	6564 00	278.98	4 25	300	
Simon	G Friesland	3 years	7888 90	297 20	3.78	300	P. Freeland, Lingfield, Gwelo.
Kirstein	G. Friesland	Mature	5975 70	228.74	3.83	286	G G Futter, Marjoribanks, P.O Gwelo.
Daisybelle	G. Guernsey	4 years	6263.50	283 85	4 53	300	
Nixon	G. Friesland	Mature	5500.70	239 72	4.36	246	
No. 114	G. Friesland	Mature	6320.30	237 02	3 75	272	W N Gebbie, P B 19A, Salisbury.
No. 139	G. Friesland	Mature	5196.00	230.41	4 43	242	
No. 146	G. Friesland	Mature	5905.80	259.09	4.39	254	
No. 148	G. Friesland	Mature	5665.00	266.31	4.70	300	
No. 168	G. Friesland	4 years	5505 40	230.66	4 19	244	
No. 99	G. Friesland	Mature	7481 50	250.59	3.35	300	

SEMI-OFFICIAL—(Continued).

Name of Cow.	*Breed.*	*Age.*	*Milk in lbs.*	*B. Fat in lbs.*	*Average % B. Fat.*	*No. of Days.*	*Name and Address of Owner.*
Ducky	G. Friesland	Mature	9437.00	283.78	3.11	300	Hon. H. V. Gibbs, Bonisa, Redbank, Bulawayo.
Golly	G. Friesland	Mature	7704.00	241.05	3.13	300	
Harriet	G. Friesland	Mature	7150.00	255.40	3.57	274	
Holly	G. Friesland	Mature	9247.00	284.99	3.08	300	
Mabel	G. Friesland	Mature	12244.00	381.52	3.12	300	
Rene	G. Friesland	Mature	8338.00	279.10	3.35	261	
Ethel	G. Friesland	Mature	7652.00	277.24	3.62	297	
Pixie	G. Friesland	Mature	10769.00	395.97	3.68	300	
No. 112	G. Red Poll	Mature	8420.50	290.06	3.44	300	Government Experiment Station, P.B. 19K, Bulawayo.
No. 198	G. Red Poll	4 years	8274.00	335.04	4.05	300	
No. 145	G. Red Poll	Mature	9455.90	309.10	3.27	300	
No. 205	G. Red Poll	3 years	8717.70	324.15	3.72	238	
Eunice	G. Friesland	3 years	8302.40	302.30	3.64	360	Government Demonstration Farm, Umshandige, Fort Victoria.
Jewel	G. Friesland	Mature	10009.00	354.35	3 54	300	
Lovable	G. Friesland	4 years	9563 00	314.36	3.29	300	
Pansy	G. Friesland	Mature	9166.50	316.22	3.45	300	
Sweetheart	G. Friesland	Mature	10740.10	355.16	3.31	300	
Susie	G. Friesland	4 years	7206.20	269.92	3.75	300	
Yvonne	G. Friesland	Mature	10572.60	368.34	3.48	300	
Buffalo	G. Friesland	Mature	8559.50	312.28	3.65	256	Government Farm, Gwebi, P.B. 76B, Salisbury.
Gwebi Mosquito	G. Friesland	3 years	7774.50	306.77	3 94	256	
Lightning	G. Friesland	Mature	10105.00	346.11	3 42	283	
Spitfire I	G. Friesland	Mature	8347.50	272.03	3.26	300	
Vengeance	G. Friesland	Mature	9043 50	294.14	3.25	261	
No. 24	G. Friesland	3 years	6368.00	233.57	3.67	300	
No. 25	G. Friesland	3 years	8921.50	295.14	3.31	300	
No. 29	G. Friesland	2 years	9697.00	345.68	3.56	263	
No. 30	G. Friesland	3 years	8144.50	277.19	3 40	279	
No. 32	G. Friesland	3 years	8967.50	347 15	3 87	300	
No. *34	G. Friesland	2 years	6051.00	241.93	4 00	260	
No. 113	G. Friesland	Mature	7546 50	284.38	3.77	240	
No. 138	G. Friesland	Mature	6775.50	250.10	3.69	252	
No. 141	G. Friesland	Mature	7329.00	235.00	3.21	200	
No. 166	G. Friesland	Mature	7703.00	233.03	3.02	227	
No. 186	G. Friesland	Mature	7931.50	316.55	3.99	279	
No. 100	G. Friesland	Mature	10281.00	382.25	3.72	300	

No. 2	G. Friesland	Mature	10533.00	397 25	3 77	257	Grasslands Experiment Stn., Marandellas
No. 11	G. Friesland	Mature	9454.50	324.36	3.43	269	
No. 61	G. Friesland	4 years	9529.00	336.76	3.53	300	
No. 64	G. Friesland	3 years	8061 00	294.68	3.66	282	
No. 65	G. Friesland	3 years	6699.00	264.99	3 96	300	
No. 68	G. Friesland	3 years	8327.00	296 18	3.56	300	
No. 74	G. Friesland	2 years	8591.50	344.73	4.01	300	
No. 42	G. Friesland	Mature	6635.00	257.79	3 89	136	
Empress D. 185	G. Friesland	3 years	8199 10	302.33	3 69	275	E. E. C. Green, Box 879, Bulawayo.
James	G. Guernsey	3 years	5004.00	271 36	5 42	300	E. J. Hards, Churchill Farm, Marandellas.
Machai II	G. Guernsey	4 years	4817.00	237.56	4.93	300	
Ada	G. Guernsey	Mature	6986.80	276.98	3 96	300	D. A. Hartley. Harleyton, P.O Beatrice.
Anne	G. Guernsey	Mature	6319.40	256.05	4 05	300	
Audrey	G. Guernsey	Mature	6233 80	240.06	3.85	300	
Dainty	G Guernsey	Mature	6857.50	276 40	4.03	300	
Dorothy	G. Guernsey	Mature	7083.70	277.69	3.92	300	
Eileen	G. Guernsey	Mature	5659.00	226 33	4 00	241	
Heather	G. Guernsey	Mature	7304 20	275.23	3 77	300	
Phyllis	G. Guernsey	Mature	6574.90	237 47	3 61	300	
Thelma	G. Friesland	Mature	6747 30	256 46	3.80	300	
Victoria	G. Guernsey	Mature	6659 10	285.44	4 29	300	
Alison	G. Guernsey	3 years	6476 70	236.63	3.66	300	
Dallas	G Guernsey	Mature	6044.90	233.93	3 87	286	
Gloria	G. Guernsey	Mature	5877 30	252 81	4.30	254	
Kathleen II	G. Guernsey	3 years	4504 00	229 87	5.10	289	
Lotty	G Guernsey	Mature	5770 60	235.62	4 08	300	
Lucy II	G. Guernsey	Mature	5848 30	246 49	4 21	273	
Ruth	G. Guernsey	Mature	5704 90	244.56	4.29	242	
Adye	G Guernsey	Mature	7790 40	300 79	3 86	300	
Alma	G. Guernsey	Mature	9446.50	378 87	4.01	300	
Bertha	G. Guernsey	Mature	8119 40	269.66	3.32	300	
Ethel	G. Guernsey	Mature	6264.90	277 91	4 44	300	
Primrose	G. Guernsey	Mature	6919 00	316.94	4.58	300	
Susie	G. Guernsey	4 years	5315.00	237.11	4.46	300	
Vida	G. Guernsey	Mature	6802.00	289 17	4 25	292	
Biddy	G. Guernsey	Mature	5762 70	245 45	4.26	170	Mrs. L. M. H. Howard, Nengwa Farm, P.O. Beatrice.
Lucy	G. Guernsey	Mature	5835.90	273.53	4.69	125	
Patsy	G. Guernsey	4 years	6135.20	297.96	4.85	263	
Sophie	G. Friesland	Mature	7144.50	251 33	3.52	247	

SEMI-OFFICIAL—(Continued).

Name of Cow.	*Breed.*	*Age.*	*Milk in lbs.*	*B. Fat in lbs.*	*Average % B. Fat.*	*No. of Days.*	*Name and Address of Owner.*
Buttercup	G. Friesland	Mature	8767.10	289.25	3.30	300	D. J. Huddy, Box 718, Salisbury.
Driekol II	G. Friesland	Mature	8186.20	312.91	3.82	284	
Flossie	G. Friesland	Mature	7471.80	262.58	3.51	265	
Jess	G. Friesland	Mature	6366.20	225.92	3.55	239	
Lulu	G. Friesland	Mature	7949.40	244.47	3.08	257	
Matilda	G. Friesland	Mature	5989.00	268.79	4.49	229	
Pam	G. Friesland	3 years	7072.00	252.48	3.57	236	
Vixen	G. Friesland	Mature	7710.80	279.01	3.62	256	
Witkwas	G. Friesland	Mature	8487.80	309.11	3.64	292	
No. 67 (Saanie)	G. Friesland	Mature	6143.40	226.95	3.69	248	
Belinda	G. Friesland	Mature	7006.60	285.74	4 08	253	
Koffie	G. Friesland	Mature	7788.70	266.03	3 42	300	
Bindura	G. Friesland	Mature	5942.60	263.03	4 43	237	L. Huddy, Box 924, Salisbury.
Pixie	G. Guernsey	Mature	7071.20	278.25	3.93	248	
Ivy	G. Friesland	Mature	7944.80	240.83	3 03	294	
Radio	G. Friesland	Mature	6519.70	235.65	3 61	275	
Brenda	G. Guernsey	Mature	7198.00	265.81	3 69	300	Mrs. M. R Huddy, P.O Box 899, Salisbury
Maud	L.R. Shorthorn	Mature	6661.00	225.02	3 38	267	
Mona	G. Guernsey	Mature	7721.00	293.54	3 80	300	
Pansy	G. Guernsey	Mature	5939.00	250 02	4.21	300	
Moyeni Valiant Jingle Bell	P.B. Jersey	Mature	6699.00	366.06	5.46	300	J. A. G. Hughes, Bains Hope, P.O. Melfort.
Reno	G. Friesland	4 years	9331.00	307 38	3 29	300	
Gem I	G. Red Poll	Mature	4835.90	248.51	5 14	300	A. Patton Jamieson, Dunsappie, Theydon
Rosalind	G. Jersey	Mature	7000.60	293.12	4.19	300	
No. 30	G. Friesland	Mature	8774 00	309.70	3.53	300	D. S. Kabot, Box 261, Bulawayo.
No. 44	G. Friesland	4 years	9641 00	369 44	3.83	300	
No. 63	G. Friesland	2 years	8956.50	325.61	3.64	300	
No. 67	G. Friesland	Mature	9924.00	315 58	3 18	300	

No. 5	G. Friesland	Mature	6689 63	248.63	3.72	300	B. H Kew, Box 972. Bulawayo.
J.66	G. Friesland	Mature	8254.90	291.87	3.54	300	
K.17	G. Friesland	Mature	7556 80	254.09	3 36	300	
K.21	G. Friesland	Mature	8497.30	317 30	3.74	300	
K.24	G. Friesland	Mature	7060.70	246.79	3 50	283	
K.28	G. Friesland	4 years	9284.70	281.39	3.03	300	
K.35	G. Friesland	3 years	6505 20	242 88	3.73	300	
No. 16	G. Friesland	Mature	10185.90	344 08	3.38	300	
D.14	G. Friesland	Mature	8932.70	302.85	3 39	300	
K. 6	G. Friesland	Mature	7806 80	298 33	3.82	300	
K.27	G. Friesland	4 years	6741.20	277.41	4.12	300	
Bluebell	G. Friesland	Mature	6602 00	259 55	3.93	279	D King, Rockwood Farm, Concession.
Doreen	G. Friesland	3 years	6599.00	299 20	4.53	276	
Marimba	G. Friesland	2 years	6089.00	231 75	3.81	300	
Pickles	G. Friesland	2 years	6910.00	321.35	4 65	300	
Violet	G. Friesland	Mature	8269 50	338 29	4.08	299	
Janet	G. Friesland	3 years	8521.00	282 37	3 31	294	
Kingston Bessie	G. Friesland	Mature	7371.00	278 36	3 78	276	Kingston Farm Syndicate, Box 2. Bindura.
Kingston Dinner	G. Friesland	3 years	6846 00	263 67	3.85	300	
Kingston Town	G Friesland	3 years	6148 00	241.41	3.93	300	
Kingston Bandie	G. Friesland	3 years	6894 00	282 14	4 09	300	
Pinafore II	G. Friesland	3 years	5893.30	260.56	4.42	300	H A. Knill, Mendamu, Marandellas.
Borki II	G. Friesland	4 years	6009 80	246 00	4.09	300	
Monkey Nuts I	G Friesland	Mature	8731 00	306 47	3.51	300	
Odera II	G. Friesland	4 years	7835 70	275 87	3.53	300	
Pennance III	G. Friesland	3 years	6074 00	239 93	3.95	300	
Rosandra	G. Friesland	2 years	6535 80	227 87	3.49	300	Mrs. M M Krahner, Haydock Park, Banket
Charmaine	G. Friesland	Mature	6335 70	301 87	4.76	300	
No. 8	G. Friesland	Mature	6213 30	233 84	3 76	300	H. T. Lay. P B. 107C. Salisbury.
No. 10	G. Friesland	4 years	6233 70	242 90	3 90	300	
No. 12	G. Friesland	Mature	6479.80	258 05	3 98	300	
No. 20	G. Friesland	Mature	5761.60	260 16	4.52	269	
No. 22	G. Friesland	4 years	5965.90	235 10	3.94	300	
No. 39	G. Friesland	4 years	6874 00	278 67	4 05	300	
No. 40	G Friesland	4 years	7282.40	286.40	3 93	300	
No. 41	G. Friesland	4 years	5761.10	238 09	4.13	300	
No. 24	G. Friesland	4 years	7018.50	280.14	3.99	300	
No. 36	G. Friesland	3 years	7941 80	325 37	4.10	292	

SEMI-OFFICIAL—(Continued).

Name of Cow.	*Breed.*	*Age.*	*Milk in lbs.*	*B. Fat in lbs.*	*Average % B. Fat.*	*No. of Days.*	*Name and Address of Owner.*
Bichaan	G. Friesland	Mature	7728.00	267.75	3.46	300	P. Linton, Box 898, Salisbury.
Cigarette II	G. Friesland	Mature	8040.70	309.31	3.85	300	
Jempee II	G. Friesland	Mature	8812.00	324.49	3.68	300	
Kajongkus II	G. Friesland	Mature	6610.40	243.76	3.69	300	
Makey II	G. Friesland	Mature	6835.60	248.80	3.64	300	
Maplank	G. Friesland	Mature	7518.60	299.78	3.99	300	
Sixpence III	G. Friesland	Mature	7283.30	236.64	3.25	267	
Skea II	G. Friesland	Mature	6446 70	275.97	4.28	300	
Tennis I	G. Friesland	Mature	7040.40	257.20	3.65	300	
December II	G. Friesland	4 years	7855.80	298.85	3.80	300	
Alice	G. Friesland	Mature	8911.00	271.06	3.04	300	J. N. L. MacIlwaine, Box 23, Marandellas.
Olivia	G. Friesland	4 years	6316.00	238.89	3.78	300	
Ivy	G. Friesland	4 years	6874.00	273.71	3.98	300	
Whinburn Bracken	G. Friesland	3 years	5446.50	244.80	4.49	300	
Zonga Queen VI	G. Friesland	Mature	6013.00	239.80	3.99	278	
Lydia	G. Friesland	Mature	8076.00	268.07	3.32	300	J. MacIntyre, Box 58, Shamva.
Monica	G. Friesland	Mature	5388.00	227.58	4.22	188	
Maisie	G. Brown Swiss	Mature	6955.00	294.19	4.23	300	J. Mares, Julias Dale Farm, P.B. Rusape
Sophy	G. Afrikander	Mature	6435.70	271.28	4.21	246	C. J. Marshall, P.O. Box 654, Bulawayo.
No. 1	G. Friesland	Mature	10607.60	342.73	3.23	300	D. W. Marshall, Alderbury, Box 164, Umtali.
Lopear	G. Friesland	Mature	8868.30	337.97	3.81	300	
Linda	G. Friesland	2 years	6576.90	263.54	4.01	300	
Lorna	G. Friesland	2 years	6625.10	258.64	3.92	300	
No. 13	G. Friesland	Mature	7514.10	275.37	3.66	300	
No. 20	G. Friesland	Mature	8230.20	329.30	4.02	300	
Clover	G. Friesland	Mature	7515.50	292.23	3.89	300	
Mary	G. Friesland	3 years	5923.80	235.36	3.97	300	
Players	G. Friesland	Mature	7168.20	256.04	3.57	300	
Makwin	G. Jersey	Mature	6783.40	352.00	5.19	300	Lt.-Col. C. I. F. Maynard, Melfort, P.B. 112C, Salisbury.
Noratu	G. Red Poll	3 years	8852.70	387.00	4.37	300	
Rosa	G. Jersey	Mature	6462.10	336.57	5.21	300	
Spot	G. Red Poll	3 years	5859.30	228.87	3.91	271	

Royston	G. Friesland	Mature	7118.10	243.61	3.42	300	J. U. McCay, P.B. J181, Bulawayo.
No. 102	G. Friesland	Mature	6681.60	249.16	3.73	300	
No. 106	G. Friesland	Mature	7678.40	263.31	3.43	300	
Adelaide	G. Friesland	3 years	7686.90	306.45	3.99	300	J. H. McLean, Box 161, Gwelo.
Knykop	G. Ayrshire	Mature	5968.80	232.79	3.90	300	
P.7/8	P.B. Friesland	Mature	8620.00	265.35	3.08	300	Meikles Trust & Invest. Co., Ltd., Leachdale Farm, Shangani
P.25/0	P.B. Friesland	Mature	11343.00	402.79	3.55	300	
P.30/3	P.B. Friesland	3 years	6684.00	240.49	3.60	300	
G.2/1	G. Friesland	Mature	8216.00	312.70	3.81	300	
G.5/2	G. Friesland	Mature	7009.00	265.95	3.79	253	
G.22/3	G. Friesland	4 years	6674.00	268.42	4.02	300	
G.49/3	G. Friesland	4 years	9532.00	313.92	3.29	300	
G.50/3	G. Friesland	4 years	8572.00	334.51	3.90	300	
No. 187	G. Friesland	Mature	7719.00	283.08	3.67	300	
P.15/0	P.B. Friesland	Mature	9358.00	333.20	3.45	300	
G.3/4	G. Friesland	3 years	7375.00	275.48	3.74	292	
G.9/4	G. Friesland	3 years	8173.00	290.95	3.56	300	
G.4/9	G. Friesland	Mature	11126.00	360.14	3.24	300	
Sally	G. Red Poll	Mature	5320.70	230.66	4.34	300	Capt. B. L. Miles, Muneni, P.O. Banket.
Ida	G. Red Poll	Mature	5848.00	250.52	4.28	258	C. F. Mitchell, Manzana Farm, Essexvale.
Laura	G. Red Poll	Mature	8326.00	292.76	3.52	253	
Twenty	G. Friesland	Mature	5094.10	226.32	4.44	279	Misses I. and J. Mitchell, Argyll, Odzi.
Tickey	G. Jersey	Mature	5437.00	258.38	4.75	300	J. J. Mitchell, Box 625, Bulawayo.
Dahlia	G. Shorthorn	Mature	5115.70	270.78	5.29	298	C. Moorhouse, Odzi Drift, Box 9, Umtali.
Martha	G. Friesland	Mature	6605.70	230.99	3.50	300	Com. E. L. Morant, Box 741, Salisbury.
Rita	G. Friesland	Mature	6542.60	279.80	4.28	300	
Royce	G. Ayrshire	Mature	6527.20	319.78	4.90	288	
Ursula	G. Ayrshire	3 years	5131.40	245.32	4.78	300	
Darkie	G. Friesland	2 years	5843.50	242.42	4.15	289	C. F. S. Morkel, Two Streams, P.O. Macheke.
Caserta	G. Friesland	3 years	5031.00	239.95	4.77	274	G. R. Morris, P.O. Box 1040, Salisbury.
Lucia	G. Friesland	Mature	8717.00	302.92	3.48	300	
Malingosi	G. Friesland	Mature	9208.00	305.87	3.32	300	
Merle	G. Guernsey	Mature	6881.00	304.86	4.43	300	
Princess Marina	G. Friesland	4 years	6816.00	317.91	4.66	300	
Mrs. Simpson	G. L.R./Shorthorn	Mature	5976.00	236.08	3.95	248	
Dinkie	G. Guernsey	Mature	6550.00	257.59	3.93	297	

SEMI-OFFICIAL—(Continued).

Name of Cow.	Breed.	Age.	Milk in lbs.	B. Fat in lbs.	Average % B. Fat.	No. of Days.	Name and Address of Owner.
No. 67	G. Friesland	Mature	8849.50	267.85	3.03	300	F. B. Morrisby, Box 36, Gwelo.
No. 126	G. Friesland	Mature	8977.00	276.83	3.08	300	
No. 131	G. Friesland	Mature	8443.00	272.59	3.23	300	
No. 138A	G. Friesland	Mature	7961.00	292.11	3.68	300	
No. 154	G. Friesland	Mature	7819.00	254.84	3.26	300	
No. 144	G. Friesland	Mature	10215.00	350.65	3.43	300	
No. 148	G. Friesland	Mature	6502.00	230.64	3.55	300	
No. 149	G. Friesland	Mature	6948.00	241.19	3.47	300	
No. 157	G. Friesland	Mature	9225.00	281.96	3.06	300	
Alice	G. Friesland	4 years	6373.60	229.23	3.60	300	J. T. Mungle, Myreside, Odzi.
Chikopa	G. Friesland	Mature	6388.50	233.98	3.66	288	
Headlands	G. Friesland	Mature	4695 90	225.27	4.80	288	
Jane	G. Friesland	Mature	5802.80	267.45	4.61	290	
June	G. Friesland	Mature	6480.20	307.36	4.74	300	
Nessie	G. Friesland	Mature	6582.20	245.10	3.72	300	
Ossak	G. Friesland	Mature	6237 50	273.30	4 38	300	
Raisen	G. Red Poll	Mature	5538.00	249.15	4.52	262	
Sophie	G. Red Poll	2 years	5581.40	242.61	4.35	300	
Zabron	G. Red Poll	Mature	6274.30	242.86	3 89	286	
Beth	G. Friesland	3 years	5959 00	236.14	3.96	300	
Imbuya	G. Friesland	Mature	5899.50	279.12	4.73	300	
Jenehuma	G. Friesland	Mature	6811.30	227.75	3.34	300	
Longone	G. Friesland	Mature	5963.60	247.43	4.15	300	
Manyerket	G. Friesland	Mature	6599.60	270.43	4.10	300	
White I	G. Friesland	3 years	5705 40	225.82	3.96	300	
Dulcie I	G. Friesland	4 years	6414.00	254 88	3.97	300	K. Norvall, Box 637, Bulawayo.
Evelyn II	G. Friesland	3 years	6934.00	233.16	3.36	300	
Exwell Marie III	P.B. Friesland	Mature	6857.00	255.94	3.73	300	
Sausage	G. Red Poll	Mature	6866.00	294.59	4 29	273	
Sisi	G. Friesland	4 years	7368.00	255.76	3.48	300	
Turkey	G. Friesland	Mature	7636.00	262.13	3.43	284	
Exwell Betty I	P.B. Friesland	4 years	7638.00	298.09	3.90	300	
Bell	G. Friesland	Mature	10864.90	405.05	3.73	300	Estcourt Palmer, Ferndale, Penhalonga.
Chbakera	G. L.R./Shorthorn	Mature	8263.90	332.63	4.03	300	
Daisy	G. Friesland	Mature	11459.20	441.72	3.85	300	

Jenny	G. Friesland	Mature	9837.90	399.80	4.06	278	Estcourt Palmer, Ferndale, Penhalonga.
Maisie II	G. L.R./Shorthorn	Mature	7912.70	380 90	4.81	249	
Norris	G. Guernsey	2 years	6658.00	302.50	4.54	272	
Stella	G. L.R./Shorthorn	Mature	6967.60	263.09	3 78	234	
Kettelan II	G. Shorthorn	4 years	6724.70	265.33	3.95	256	
Sally	G. L.R./Shorthorn	4 years	6482.50	252.11	3.90	230	
Middledam Prim Sybil	P.B. Jersey	3 years	4615.10	252.44	5 47	273	Mrs E. L Parkes, P.O. Box 159, Salisbury
Samuelle	G. Jersey	3 years	6641.60	324 53	4.89	300	
Dolly	G. Friesland	Mature	10641.50	324.82	3.05	300	Mrs. M. Parsons, P O Box 7, Bulawayo.
May	G. Friesland	Mature	9728.50	332 74	3.42	300	
Ranchmere	G. Friesland	Mature	14403 00	443.54	3.08	300	
Seven	G. Friesland	Mature	8287.00	367.98	4.44	300	
Blanche	G. Friesland	2 years	9601.00	287.59	3 00	300	
Customs	G. Friesland	Mature	14087 00	486 45	3.31	300	
Edna	G. Friesland	Mature	11979 00	368.94	3.08	300	
Elaine	G. Friesland	2 years	9077.50	303.91	3.35	300	
Ellie	G. Friesland	2 years	8130.50	308.64	3 80	300	
Iris	G. Friesland	2 years	5756.50	284.10	4.94	300	
Margaret	G. Friesland	3 years	11,385.50	371.17	3.26	300	
Smithy	G. Friesland	2 years	6835 00	225.83	3.30	300	
Susie	G. Friesland	2 years	6692.50	226 51	3 38	300	
No. 14	G. Friesland	Mature	6858 00	232.32	3 39	300	T. C. Pascoe, Box 1253, Salisbury.
No. 88	G. Friesland	Mature	8755.50	333 52	3 81	300	
No. 106	G. Friesland	Mature	6514 00	244.01	3.75	300	
No. 108	G. Friesland	Mature	6913.00	240.08	3.47	300	
No. 150	G. Friesland	Mature	7880.00	294.41	3 74	300	
No. 189A	G. Friesland	3 years	5957.00	240.62	4 04	300	
No. 130A	G Friesland	3 years	5542.00	229.31	4.14	300	
No. 137	G. Friesland	Mature	5963.00	249 40	4 18	300	
No. 186A	G. Friesland	3 years	5664.00	226.19	4 00	300	
No. 198	G. Friesland	Mature	6307.00	243.43	3.86	300	
No. 2	G. Friesland	Mature	6857 00	275.98	4.02	300	J Picken, Iron Mine Hill Farm, P.O. Iron Mine Hill.
Augusta	G. Friesland	2 years	7614 50	245.87	3 23	300	Red Valley Estate, Lushington, Marandellas.
Bettafit	G. Friesland	Mature	8506 30	320.08	3 76	300	
Bettapatsy	G. Friesland	Mature	8618 40	297.76	3.46	300	
Elysoun	G. Friesland	Mature	8337.80	310 63	3.72	300	
Julia	G. Friesland	Mature	9543.10	347.41	3.64	300	
Roberta	G. Friesland	4 years	5718 50	227.66	3.98	260	

SEMI-OFFICIAL—(Continued).

Name of Cow.	*Breed.*	*Age.*	*Milk in lbs.*	*B. Fat in lbs.*	*Average % B. Fat.*	*No. of Days.*	*Name and Address of Owner.*
Rita	G. Friesland	Mature	6107.00	242.99	3.98	295	Mrs. Worthington Reed, Box 19, Gwelo.
Sandy	G. Friesland	Mature	6344.00	267.88	4.22	278	
Suide	G. Shorthorn	2 years	6125.00	247.83	4.05	300	
Daisy	G. Friesland	Mature	6769.00	233.96	3.46	300	Rhod. Corporation Kent Estate, Norton.
Marvel	G. Friesland	Mature	5789.00	236.39	4.08	300	
Delia	G. Friesland	Mature	8494.00	375.35	4.42	300	
Chicondani	G. Friesland	Mature	7840.70	282.50	3.60	300	G. W. Robinson, P.O. Box 346, Salisbury.
Ruth	G. Friesland	Mature	8470.20	347.95	4 11	300	
White	G. Friesland	Mature	8442.80	325.67	3.86	300	
Yemu	G. Friesland	Mature	6577 80	252.50	3.84	300	Mrs. M. Rogers, Bickford, Gwelo.
Alice (No. 20)	G. Friesland	4 years	7172.60	251.58	3.51	300	Mrs. D. H. Rutherford, Igava, P.O. Marandellas.
Martha (No. 18)	G. Friesland	4 years	6383.00	255.97	4.00	300	
Harriet (No. 14)	G. Friesland	Mature	6033.00	261.17	4.33	300	
Bluebell	G. Friesland	3 years	5645.10	277 86	4.92	300	
Tippett (No. 7)	G. Friesland	Mature	6499.30	250.04	3.85	300	
Avurundiya	G. Friesland	Mature	7254.20	246.00	3.39	300	W. F. H. Scutt, Maple Leaf, Norton.
Coffee	G. Friesland	Mature	7000.60	262 70	3.75	300	
Langis	G. Friesland	4 years	6930.20	282 52	4.08	300	
Simon	G. Friesland	Mature	7126.60	326.95	4.59	300	
Bloombury III	G. Friesland	3 years	5536 00	243 58	4.40	300	E. Stanger, Chimbi Source, Rusape.
Pansy	G. Friesland	4 years	5915.00	230.03	3.89	300	
Violet	G. Friesland	4 years	5462.00	249 93	4.58	300	
Catherine VI	G. Friesland	3 years	5342.00	239.24	4.48	300	
Chekamunda III	G. Friesland	Mature	4863.00	243 52	5.01	279	
Annabel	G. Friesland	Mature	8049 50	277.38	3.45	300	Lt.-Col. F. H. Stead, Box 56, Gwelo.
Blanco	G. Guernsey	Mature	8131 00	330.48	4.06	291	
Dulcie I	G. Friesland	Mature	7637.50	236.22	3.09	300	
Musk	G. Friesland	3 years	5646 00	243.55	4.31	273	
Battle Fame	P.B. Ayrshire	Mature	7812.00	342 50	4.38	300	J. R. Stewart & Sons, Ltd., Battle Farm, P.O. Shangani.
G.3	G. Ayrshire	Mature	5865.00	236 09	4.03	249	
P.17	P.B. Ayrshire	Mature	7655.00	289 59	3.78	261	

G.14	G. Ayrshire	3 years	6439.00	278 27	4 32	279	J. R. Stewart & Son, Battle Farm, P.O. Shangani.
G.21	G. Ayrshire	Mature	6827 00	291.17	4.26	300	
Sundu	G Brown Swiss	Mature	5094.50	242.29	4.76	266	T. Steyn, Welgevonden, P.O. Greystone.
Renaire	G. Red Poll	Mature	4775 80	246.86	5 17	276	H. Stobart, Atlanta, Arcturus.
Christine	G. Friesland	Mature	7673.00	293 04	3.82	300	Susman & Newfield, Box 959, Salisbury.
Cloud	G. Friesland	4 years	12680.00	422.72	3 33	300	
Jerena	G Friesland	Mature	8027.00	275 68	3.43	300	
Odera	G. Friesland	Mature	7491.00	279.43	3.73	300	
Pennance	G. Friesland	Mature	7218.00	266.11	3.69	300	
Pyjamas	G. Friesland	Mature	9015 00	306.23	3 40	300	
Zambesi	G. Friesland	Mature	8511.00	300 72	3 53	300	
S/19	G. Friesland	4 years	8870 00	284.59	3.21	300	
S/20	G. Friesland	3 years	9791.00	328.36	3.35	300	
Klok	G. Friesland	Mature	8181 00	302.68	3 70	300	
Pillow	G. Friesland	Mature	7854.00	271.71	3 46	300	
Tube	G. Friesland	Mature	7781 00	284 04	3 65	300	
S/9	G. Friesland	4 years	6414.00	286.72	4.47	300	
S/11	G. Friesland	Mature	6606 00	258.14	3.91	300	
Julia (T. 25)	G. Friesland	Mature	9683 00	329 12	3 40	300	
Kate	G. Friesland	Mature	9046 00	281.31	3 11	300	
S/12	G. Friesland	4 years	6979 00	240 72	3.45	282	
Bromley	G. Friesland	Mature	6957 00	270 32	3 89	243	E Tapson Trust, Ltd., Lesapi Falls, Rusape.
Bucket	G. Friesland	Mature	9150.00	347 31	3.80	300	
Esther	G Friesland	3 years	6619 00	254 95	3.85	300	
Gracie	G Friesland	4 years	7209 00	307 00	4 26	268	
July	G. Friesland	3 years	6401 00	258 28	4.03	298	
Makoni	G Friesland	Mature	6988.00	294 11	4.21	273	
Marion	G Friesland	Mature	6514 00	280.24	4 30	300	
Native	G. Friesland	Mature	8761.00	288 82	3 30	300	
Rosina	G. Friesland	Mature	5870.00	225.78	3 85	238	
Snowdrop	G Friesland	Mature	8873 00	312 34	3 52	300	
White II	G. Friesland	2 years	6992.00	281.11	4 02	244	
Ngamera I	G. Ayrshire	Mature	6614.00	243 41	3.63	283	
Bandit	G. Friesland	Mature	7232 00	242 49	3.35	300	
Copper	G. Friesland	Mature	5278.00	226.37	4.29	283	
Dodo	G. Friesland	2 years	7859.00	325.55	4.14	300	

SEMI-OFFICIAL—(Continued).

Name of Cow.	*Breed.*	*Age.*	*Milk in lbs.*	*B. Fat in lbs.*	*Average % B. Fat.*	*No. of Days.*	*Name and Address of Owner.*
Enya	G. Ayrshire	Mature	5821.00	251.62	4.32	246	E. Tapson Trust, Ltd., Lesapi Falls, Rusape.
Frossina	G. Ayrshire	Mature	5036.00	236.11	4.69	300	
Gunda	G. Ayrshire	Mature	6308.00	275.24	4.36	243	
Jumbe	G. Ayrshire	3 years	5362.00	245.95	4.59	278	
Mabolt	G. Ayrshire	Mature	5988.00	243.11	4.09	294	
Maxim	G. Ayrshire	Mature	7106.00	263 59	3 71	298	
Newlands	G. Friesland	Mature	9077.00	341.85	3.77	289	
Piccanin	G. Friesland	Mature	7247.00	300.01	4.14	300	
Lusiya	G. Ayrshire	3 years	5083.00	234.40	4.61	208	
Connie	G. Friesland	4 years	9676.80	344.43	3.56	300	A. W. Tennent, Kelvin, Headlands.
Maggie	G. Friesland	Mature	7320.70	287.89	3.93	300	
Mareta	G. Friesland	Mature	7388.30	279.23	3.78	300	
Maude	G. Friesland	4 years	7134.10	247.24	3 47	300	
Pat	G. Friesland	Mature	7385.40	286.36	3.88	300	
Susan	G. Friesland	4 years	6238.50	237 70	3.81	281	
No. 11	G. Friesland	3 years	6358.80	261.68	4.12	300	
No. 13	G. Friesland	3 years	5584.10	230 59	4.13	281	
Boy	G. Friesland	Mature	6544.80	253.18	3.87	269	
May	G. Friesland	2 years	5994.40	248.98	4.15	300	
Monday	G. Friesland	Mature	6983 40	259.58	3.72	300	
Rosie	G. Friesland	Mature	5995.70	236 61	3.95	255	
No. 24	G. Friesland	3 years	5236.20	229.11	4.38	300	
No. 25	G. Friesland	3 years	6194.40	229.33	3.70	300	
No. 27	G. Friesland	2 years	5816.30	228.97	3.94	300	
No. 28	G. Friesland	2 years	6474.40	261.04	4.03	300	
No. 42	G. Friesland	2 years	5964.00	233.86	3.92	300	
No. 16	G. Friesland	2 years	4851.50	244 67	5.04	289	H. A Tennent. Maidstone, Rusape.
No. 20	G. Friesland	2 years	5186 40	248 50	4.79	289	
Dorika	G. Friesland	Mature	5342.70	231.19	4.32	300	J. G. Thurlow, Atherstone, Bindura.
Mangashu	G. Red Poll	Mature	6819 80	282 43	4.14	300	
Nyagooi	G. Red Poll	Mature	6853.20	267.04	3.90	251	
Nyasaland	G. Shorthorn	Mature	7601 10	279 70	3.68	287	

Beans	G. Friesland	Mature	4566.60	254.44	5 57	213	R. Thwaites, Stow, Marandellas.
Blanco IV	G. Friesland	Mature	5725.00	241.33	4 21	300	P. S. Timms, Chitora, Rusape.
Makoni Rita III	G. Friesland	Mature	7284.00	233.62	3.21	300	
Tulip II	G. Friesland	Mature	6091.00	261.34	4.29	300	
Carla	G. Friesland	Mature	9590.70	328.64	3.43	300	C. G Tracey, Handley Cross, P.B. Gatooma.
No. 125	G. Red Poll	Mature	7457.00	302.42	4 06	300	A. M. Tredgold, P.B. 61L, Bulawayo.
No. 165	G. Red Poll	Mature	6066.50	242 99	4.01	291	
No. 179	G. Red Poll	Mature	6696.00	245.44	3.67	298	
No. 181	G. Red Poll	Mature	8922.00	294 63	3.30	297	
Emma	G. Friesland	4 years	7627.30	237.68	3 10	300	Mrs M. Turnbull, Box 479, Bulawayo
Patches	G. Friesland	2 years	8201.80	264 96	3.23	300	
Dainty	G. Friesland	3 years	7803.10	265.09	3.40	274	
Jean	G. Friesland	4 years	10972 00	334 89	3.05	265	R. O Waldschutz, Mere Farm, Box 27, Marandellas.
Commeche III	G. Friesland	4 years	6597.00	230.45	3 49	253	
Coffee	G. South Devon	Mature	6755 00	276 14	4 09	300	N W Whitehead Lonsdale Farm, P.O. Matopos
Magodene	G. South Devon	Mature	5185.50	266 16	5 11	279	
Buttercup II	G. South Devon	4 years	5858 70	227 03	3 89	300	
Charity	G. Red Poll	4 years	5848 30	256 36	4 38	300	
Duchess	G. Friesland	3 years	5963 00	236 11	3 96	300	
Jenny	G. Red Poll	Mature	5597.30	255.19	4 56	267	
Nora	G Red Poll	4 years	7159 90	265 89	3.71	300	
Orange	G. Friesland	3 years	6533 70	270 97	4 10	300	
Wendy	G. Red Poll	Mature	6140 90	264.07	4 30	274	

Price List of Forest-tree Transplants, Ornamental Trees and Shrubs, Hedge Plants, Creepers and Seeds.

OBTAINABLE AT THE GOVERNMENT FOREST NURSERY, SALISBURY.

AS AT 1st APRIL, 1949.

1. Transplants of forest trees, etc., are obtainable at the subjoined rates and subject to stocks and containers being available.

2. Orders should be addressed to the Chief Conservator of Forests, Salisbury; or Manager, Forest Nursery, P.O. Box 387, Salisbury.

3. **All orders must be accompanied by a remittance in cash, bank note, postal order, draft or cheque, made payable to the Department of Agriculture, Salisbury. Under no circumstances will plants or seeds be sent out or taken away from the Nurseries unless paid for. Stamps to the value of one shilling will be accepted.**

4. All transplants are despatched at Rate 10 on railways at purchaser's risk. The transplants are watered as far as this is possible by the railway staff.

5. All prices quoted are for delivery free at any railway station or siding in Southern Rhodesia. **Road motor service charges are payable by consignee and must be included in remittances, otherwise plants will be railed to nearest Station or Siding.**

6. Purchasers of trees contained in boxes of 50 trees are requested to return boxes, carriage forward, to the nursery from which they are obtained, or to the Manager, Forest Nursery, Salisbury. **If the boxes are not returned within two months from date of issue, they will be charged for at 1/- each respectively.**

7. Forest tree transplants only will be reserved and no guarantee can be given that ornamental trees, shrubs and climbers listed will be available. Orders for over 1,000 conifers should be placed not later than the 30th April and for over 1,000 Eucalypts not later than the 31st August immediately preceding the planting season. Orders will be executed in order of receipt and every effort will be made to comply with instructions of purchasers.

8. Transplants of forest trees, when quoted at per 1,000, are grown in boxes containing 50 transplants. The average weight of box is 50 lbs.

9. Shrubs and ornamental plants in single tins have a weight of about 5 lbs.

10. To purchasers of forest trees only, the following reductions are made:—

(a) When the number exceeds 1,000, the price is £3 5s. per 1,000.

(b) When the number exceeds 5,000, the price is £2 14s. per 1,000.

11. Orders for seed are posted or railed free of charge.

12. Though every care is taken to supply trees and seeds true to name and of good quality, no guarantee can be given in this respect, more particularly in regard to seed.

13. Intending tree planters are invited to apply to the Chief Conservator of Forests, Division of Forestry, Salisbury, for advice as to the most suitable trees for growing in the various climates and soils of the Colony, and on the best methods to adopt in the formation of plantations, wind breaks and shelter belts.

14. **No responsibility taken after trees, shrubs, etc., have been accepted by the Railways. Any claim for loss or death should be made to the Railway Company.**

15. This list cancels all previous lists.

16. Hours of Business: Weekdays, 9 a.m. to 1 p.m. and 2 p.m. to 4.30 p.m. Saturdays, 9 to 11 a.m. Closed on Sundays and Public Holidays.

Price of Transplants.—For convenience, the following symbols are used to indicate the purchase prices of transplants:—

A—Trees, 50 in box, 4s. 6d. per box; £3 5s. per 1,000; £2 14s. per 1,000 for orders over 5,000.

E—Trees and shrubs from 1s. each unless otherwise stated.

Botanical Name.	Common Name.	Remarks.	Price of trans-plants.	Price of seed. Lb.	Price of seed. Oz.
Callitris calcarata ...	Black cypress pine ...	Usually rather slow growing, but reaches a fair size and produces a valuable durable softwood. Suited for dry country planting, especially in sandy soil. Good shelter for orchards, etc.	A.E.	15s.	1s.
Casuarina cunninghamiana	Beefwood	A fine large shade tree, suitable for avenues and narrow belts. Requires deep soil in drier localities. The foliage is useful for stock fodder, and the tree stands lopping well.	A.E.	...	2s. pkt. 1s.
Cedrela odorata		A rapid-growing tree similar to Cedrela toona, but with lighter foliage. Likely to do well on heavy soils, fairly free from frost. 30 to 40 feet in height.	E.	15s.	1s.
Cedrela toona	Toon tree	A rapid-growing, handsome, semi-deciduous tree, suited for moister localities where frost is slight. Yields a valuable soft timber. Recommended for shade and ornament.	A.E.	15s.	1s
Cryptomeria japonica.....	Japanese cedar.	A quick growing coniferous tree only suitable for high rainfall areas.	E.		
Cupressus arizonica ...	Arizona cypress	A hardy evergreen tree, suitable for dry localities, but requiring a well-drained and rather deep soil. Useful for shelter belts and also for hedges when closely planted.	A.E.	15s.	1s.
Cupressus lusitanica ...	Portuguese cypress ...	A fast-growing cypress, producing an excellent softwood timber, but requires a moist, cool climate and a good soil. May well be used for shelter and hedges in favourable localities.	A.E.	5s.	6d.
Cupressus sempervirens, var. horizontalis	Common spreading cypress	A hardy cypress, suited for limestone as well as other soils. Not so frost or drought hardy as Cupressus arizonica. Suitable for shelter and hedges.	A.E.	15s.	1s.

Cupressus sempervirens, var. pyramidalis	Common upright cypress	An ornamental tree for gardens and cemeteries. Also useful as a shelter tree. Grows under similar conditions to the "var, horizontalis."	A.E.	15s.	1s.
Cupressus torulosa ...	Himalayan cypress... ...	A good tree for timber, hedges and shelter. Withstands much cold and drought. Not very soil exacting, but will not stand waterlogging. Fairly frost-hardy. A very reliable tree.	A.E.	10s.	9d.
Eucalyptus botryoides	Bangalay	A large-leaved, heavy-foliaged gum. Quick growing. Suitable for granite and red soils. Withstands frosts, but not very drought-resistant.	A.	15s.	1s.
Eucalyptus citriodora ..	Lemon-scented gum ..	A clean-boled tree, producing an excellent timber. Leaves lemon-scented. Suited for wetter regions and on the better soils in the lower rainfall regions. Will not withstand much frost or drought. Flowers prolifically, rendering it very useful for honey production.	A	15s.	1s.
Eucalyptus crebra... ...	Narrow - leaved iron-bark	A slow-growing, deep-rooting species, producing excellent timber. Withstands drought and light frosts.	A.	15s.	1s
Eucalyptus maculata ..	Spotted gum	One of the best trees for timber production or shelter in the wetter areas, being fairly hardy to drought but not to frost. Produces an excellent timber.	A	15s.	1s.
Eucalyptus maideni ..	Maiden's gum	A very fast-growing, large tree, with bluish foliage in youth Fairly drought and frost resistant. Will grow on poor soils if deep and well-drained. Produces a good, strong, useful timber.	A.	30s.	2s
Eucalyptus melliodora	Yellow box	A medium-sized tree. useful for shelter belts. Produces a tough, durable timber. Very resistant to drought and frost. Valuable for honey production, having abundant sweet flowers.	A.	15s.	1s.
Eucalyptus microcorys	Tallow-wood	A neat heavily foliaged tree suitable for high rainfall areas.	A.	15s.	1s.

Botanical Name.	Common Name.	Remarks.	Price of trans-plants.	Price of seed.	
				Lb.	Oz.
Eucalyptus paniculata	Grey ironbark	A very good timber tree, with heavy foliage. Suitable for the moister regions, with a deep, fertile soil. Withstands some drought, but is frost-tender. Yields an excellent, hard, durable wood.	A.	15s.	1s.
Eucalyptus punctata ...	Leather jacket	A tree of fair size, yielding a good, durable timber. Adaptable as regards soil and climate, but will not withstand a dry cold climate.	A.	15s	1s.
Eucalyptus rostrata ...	Red gum	Produces an excellent and durable hardwood. Withstands drought, heat, brak, flooding and a good deal of frost. One of the best species for planting in Southern Rhodesia, except in sour soil and wet mountain regions.	A.	15s.	1s.
Eucalyptus saligna... ...	Sydney blue gum	A fast-growing, useful tree, producing a useful medium hardwood. Thrives on deep, fertile soils in the heavier rainfall areas. Tender to frost and drought.	A.	15s.	1s.
Eucalyptus tereticornis	Forest red gum	Similar to Eucalyptus rostrata, and can be planted along with it, except in areas liable to flooding and great heat. Perhaps not quite as drought-resistant.	A.	15s.	1s.
Grevillea robusta	Silky oak	A handsome tree which thrives best in moist, warm localities. Useful for ornament, shade and timber. Frost-tender and not resistant to drought. If the locality is unsuitable, it may grow well for several years and then die out.	A.E.	...	pkt. 1s.

Jacaranda mimosaefolia	Jacaranda	An ornamental deciduous tree with feathery foliage and abundant blue flowers, which appear in spring. Best development is attained in the moister regions, but the tree withstands drought to a surprising extent, and may be planted in the drier regions if the soil is reasonably deep and fertile. It is tender to cold and frost, and may need protection in its earlier youth.	A.E.	20s.	1s. 3d. pkt. 1s.
Pinus canariensis	Canary Island Pine ...	Hardy to drought, but not to severe frost. Best suited for planting on higher altitudes and in higher rainfall areas. Slow growth in early youth, then more rapid in later years. A handsome tree with inverted, umbrella-like branches, not spreading. Yields an excellent softwood timber.	A.E.	15s.	1s.
Pinus halepensis	Aleppo pine	A drought-resistant pine which will grow on limestone and shale soils. Not recommended for plantations, but can be used for shelter and ornamental purposes in the drier regions.	A.E.	15s	1s.
Pinus patula...	Patula pine	A fast growing pine with graceful drooping needles. Does best in higher rainfall areas. Produces a useful softwood.	A.E.	15s.	1s.
Pinus radiata (insignis)	Remarkable pine	A large tree of very rapid growth, producing a useful softwood. Most at home in the heavier rainfall areas. Does not like sour or poorly-drained soils. Frost-hardy but not drought-resistant, usually failing at an early age in the drier regions. It should be planted with caution in areas under 30 inch rainfall. Recently this tree has been severely attacked by *Diplodia pinea* and it is advised that the Forest Department be consulted when new plantations are contemplated.	A.E.	15s.	1s.
Pinus longifolia	Chir pine	A somewhat slow-growing pine, but useful to plant in localities where the climate and soil are doubtful at the higher elevations. For timber and ornamental purposes. A useful tree in all respects.	A.E.	15s.	1s.

Botanical Name.	Common Name.	Remarks.	Price of trans-plants.	Price of seed. Lb.	Price of seed. Oz.
Populus alba	White poplar	A rapid-growing poplar, requiring a good, deep soil in close proximity to running water. Propagated by suckers. Deciduous.	Suckers at 9s. per 100		
Populus deltoides, var. missouriensis	Carolina poplar...	A very fast-growing poplar, producing a very good timber for matches. Requires a rich, moist, alluvial soil. Moderately frost-hardy. Does not like stagnant water.	E.		
Salix babylonica	Weeping willow	A useful timber and ornamental tree, requiring a moist, well-drained soil which is occasionally flooded. Not suited for ground in which water is stagnant.	4d. each.		
		Ornamental Trees, Shrubs and Hedge Plants.			
Abelia floribunda	—	A shrub with myrtle-like leaves, evergreen if watered. Pink-white flowers in profusion. Is used for hedges in Natal.	E.		
Acrocarpus fraxinifolius	—	A small tree up to 40 feet in height; attractive foliage. Fast growing.	E.		
Alstonia scholaris... ...	—	A white flowered shrub, 6 feet high, similar to Oleander.	E.		
Bauhinia acuminata ...	Bauhinia	A small tree, flowering profusely in early spring. White flowers. Hardy.	E.	...	pkt. 1s.
Bauhinia galpini	Pride of de Kaap	A rambling shrub, bearing orange-red flowers. Hardy.	E.	...	pkt. 1s.
Bauhinia purpurea ..	Bauhinia	Similar to the Bauhinia acuminata, but with mauve flowers. Hardy.	E.	...	pkt 1s
Bolusanthus speciosus	Rhodesian tree wistaria	An indigenous semi-deciduous tree with blue flowers at the end of long stalks. Ornamental.	E.		
Buddleia sp.	Blue buddleia	A medium-sized shrub with sweet-scented blue flowers. Useful as a hedge. Rapid-growing, but frost-tender.	E.		

Buddleia sp.	Yellow buddleia	A rank-growing, yellow flowering shrub. Rapid-growing. Frost-tender. Both Buddleias are very subject to leaf-eating beetles.	E.	
Callistemon speciosus	Bottlebrush	A scarlet-flowering shrub of drooping habit. Makes an excellent hedge if trimmed along the top only.	A.E.	2s. pkt. 1s.
Casimiroa edulis	Mexican apple	A large, rapid-growing tree, 30-40 feet in height, evergreen, and bears a delicious fruit. A fine shade tree if pruned to stake early.	E.	
Cassia sp.	Caruda	Evergreen tree up to 20 ft. high with masses of yellow flowers.	E.	
Cassia siamea		Grows fairly rapidly and is easy to cultivate Yellow flowers.	E.	
Cassia capensis.	Cape laburnum	A rapid-growing shrub, bearing masses of bright yellow flowers.	E.	
Castanospermum australe	Australian chestnut	A very fine shade tree similar in growth to Cedrela but with shiny evergreen leaves and pretty flowers Seeds poisonous.	E	
Citharexylum sp.	—	A deciduous shrub up to 15 ft. in height. Grown for its lovely leaves. which become highly coloured in autumn.	E.	
Croton sylvaticus	Mount Selinda linden	A large-leaved, deciduous tree from Melsetter.	E.	
Cyphomandra betacea	Tree tomato	The well-known tree tomato. Will grow anywhere where Paw Paws will thrive.	E	
Datura arborea	Tree potato	A large shrubby tree, up to 30 feet in height, with large purple flowers Very quick grower. Fruit poisonous.	E.	
Dodonea viscosa	—	Indigenous shrub. Makes a good hedge in Matabeleland but dies out after a few years in Mashonaland.	A.E.	

Botanical Name.	Common Name.	Remarks.	Price of trans-plants.	Price of seed. Lb.	Oz.
Duranta alba	White tree forget-me-not	Similar to Duranta plumieri but has white flowers.	E.		
Duranta plumieri	Tree forget-me-not... ...	A medium-sized. deciduous shrub with blue flowers. Useful as a hedge. Very hardy.	E.		
Eranthemum sp.	—	A shrubby herbaceous plant covered with intense blue flowers in the autumn, likes shade, evergreen, 3 feet high.	E.		
Eugenia braziliensis ...	Brazilian cherry	A small shrub, bearing scarlet-coloured, edible fruits. A useful hedge plant.	E.		
Euphorbia splendens ...	Christ thorn...	A small thorny shrub with bright scarlet flowers. Suitable for low hedges and borders.	E.		
Ficus petersii	Wild Fig	Indigenous tree up to 40 ft. high. Evergreen and shady, but has large surface roots.	E.		
Hamelia patens...	—	A compact shrub 8 feet to 10 feet in height, flower orange-yellow tubes, a showy shrub.	E.		
Heliotropium peruvianum	Heliotrope	A small shrub with sweet-scented lilac or nearly white flowers. Suitable in flower border.	E.		
Holmskioldia sanguinea	Holmskioldia	A fairly hardy shrub, bearing a profusion of brick-red flowers in large bunches. Suitable for hedges.	E.		
Holmskioldia sp.	Holmskioldia	A yellow-flowering, handsome shrub similar to Holmskioldia sanguinea.	E.		
Holmskioldia sp.	Holmskioldia	Similar to the above but mauve bracts and blue flowers.	E.		
Hypericum lanceolatum	St. John's wort	A small, yellow-flowering shrub. Multitudes of flowers.	E		
Iochroma tubulosa ...	Iochroma	A shrub with dark blue flowers.	E.		

Khaya nyasica	Banket Mahogany... . .	An evergreen timber tree, fairly fast growing on deep soils.	E.		
Lagerstroemia eavesii	Mauve Pride of India	Similar to Lagerstroemia indica but has mauve flowers.	E.		
Lagerstroemia indica ...	Pride of India	A large ornamental shrub, with pink flowers. Handsome and hardy.	E.		
Ligustrum lucidum ...	Chinese privet	An excellent hedge plant or ornamental shrub or tree. Can be clipped into shape. Liable to die off in patches or lose its lower leaves unless planted in moist soil of fair depth Propagated from cuttings or seeds.	A.		
Lagunaria patersonii	—	An evergreen tree with pink flowers, 30 feet high.	E.		
Mangifera indica	Mango	The well known fruit tree.	E.		
Melia azedarach	Syringa	A deciduous tree, producing a good light timber. Shallow rooting. Withstands drought well. Has fine lilac flowers and persistent yellow berries. Suitable for better rainfall areas and deep sandy soil, but will grow under severe conditions.	E		
Morus sp.	Mulberry	A very large fruited variety.	E.		
Moschosma	Rhodesia spirea	A medium-sized, blue-flowering shrub.	E		
Parkinsonia aculeata ..	Jerusalem thorn . .	A light foliaged tree, up to 20 feet high, with little yellow flowers, very beautiful as isolated specimen on a lawn.	E.		
Peltophorum africanum	Rhodesian Wattle . . .	Indigenous tree with yellow flowers.	E.		
Photinia japonica	Loquat...	A small evergreen tree with large leaves, bearing yellow edible fruit.	E.		
Phytolacca dioica .. .	Belhambra	A rapid-growing, deciduous tree. Useful for ornament. Timber of no value, but seeds valuable as a poultry or cattle feed.	A.	..	pkt. 1s

Botanical Name.	Common Name.	Remarks.	Price of transplants.	Price of seed. Lb.	Price of seed. Oz.
Pittosporum undulatum	Camphor laurel...	An Australian evergreen shrub, making an excellent hedge, with shining, green, scented leaves and scented berries.	A.		
Platanus orientalis... ...	Plane	Well known deciduous tree up to 30 ft. high. Will stand plenty of frost but apt to lose its leaves prematurely in dry areas.	E.		
Delonix regia	Flamboyant	A handsome red flowering, feathery foliaged tree. Very frost tender. Flowers best on stony ground.	E.		
Poinsettia pulcherrima	Poinsettia	A shrub with small yellow flowers surrounded by many large, scarlet, leaf-like bracts. Very showy. Double and single varieties. Also single pink variety.	E.		
Poinsettia albida	Poinsettia	As above, but with single yellowish white bracts	E.		
Punica granatum	Fruiting pomegranate	A shrub or small tree, having shining deciduous leaves, large scarlet flowers and large red fruit. Makes a useful hedge when well cut regularly.	E.		
Punica granatum flora pleni	Double flowered pomegranate	A useful shrub with double scarlet flowers. Does not bear fruit.	E.		
Pyracantha angustifolia	Hawthorn	Fruits golden and hang throughout the winter. Evergreen shrub. Useful as a coarse hedge.	A.E.		
Pyracantha crenulata ..	Hawthorn	Fruits scarlet. Evergreen shrub if watered in winter. Makes a good border or low hedge.	A.E.		
Rhus lancea...	Karreeboom...	A small indigenous tree of graceful appearance, yielding a very durable wood. Useful for ornamental purposes. Forms a fine hedge.	A.E.	10s.	9d.
Sapindus mukorossi ...	Soapberry...	Fast growing evergreen shade tree of medium height.	E.		

Schinus molle	Pepper tree...	A small evergreen tree with pendulous twigs and rose-coloured berries. Enjoys a hot sunny position but will mildew badly in humid heat. Suitable for the drier areas of the Colony only.	E.		
Schrebera sp.	—	An indigenous evergreen shrub with white flowers.	E.		
Spathodea campanulata	African flame tree... ...	A handsome, heavy-foliaged tree, bearing bright red flowers. Suited for the heavier rainfall areas on deep soils. Frost tender.	E.		
Spirea prunifolia	Cape May	White flowered shrub four feet in height, in single and double varieties.	E.		
Sterculia acerifolia... ...	Australian Flame Tree...	Medium size deciduous tree bearing masses of scarlet flowers in November.	E.		

Botanical Name.	Common Name	Remarks	Plants each.		
Sterculia discolor... ...	White Kurrajong . ..	Recommended as a shade tree for the hot dry areas of the Colony.	E.		
Sterculia diversifolia	Black Kurrajong . ..	An evergreen tree up to 30 ft. high with greenish-yellow flowers. Should do well in the hot dry parts of the Colony.	E.		
Streptosolon jamesonii	Streptosolon...	A shrub with orange-coloured flowers in dense masses and pale green foliage. Very frost-tender and delicate.	E.		
Tecoma smithii...	Tecoma	An upright, medium-sized shrub with tubular, bright yellow flowers. Forms a useful hedge. Fairly drought-resistant.	A.-E.	...	pkt. 1s
Tecomaria capensis ...	Kaffir Honeysuckle .	A pretty trailing shrub from the Cape, with orange flowers.	E.		

Botanical Name.	Common Name.	Remarks.	Plants each.	
Thuya orientalis	Thuya	A very hardy conifer that withstands heat, cold and drought, and does not mind heavy soils. Slow-growing. Of small size. Very good for hedges.	A.E.	... pkt. 1s.
Trichilia emetica	Natal Mahogany	A fine shade tree, evergreen, slow in growth, height to 30 feet, spread up to 50 feet.	E.	
Vitex Angus-Castus ...	—	A showy blue flowered shrub, does well in the most unlikely places.	E.	
		Climbers and Creepers.		
Antigonon leptopus ...	Coral Creeper	A showy climber, bright pink flowers, forms large bulbs underground. Takes two or three years to reach flowering size, after this it makes a wonderful display yearly.	E.	
Bignonia chrysoleuca...	Lemon Shower	Similar to Golden Shower with lemon coloured flowers Deciduous.	E.	
Bignonia jasminoides ..	—	An evergreen climber with mauve throated white flowers.	E.	
Bignonia tweediana ...	—	A self clinging climber with yellow flowers. Very showy whilst in flower.	E.	
Bignonia venusta	Golden shower	Vigorous creeper. Rapid-growing. Bears masses of orange flowers all the year round. Very useful and hardy.	E.	
Bougainvillaea splendens	Bougainvillaea	Vigorous climber. May be also used as a hedge. Bracts magenta. Fairly frost-hardy.	E.	
Ficus repens...	—	A valuable climber for walls, etc., used in places where the Virginia creeper is grown, but clings to the surface much better than the latter, rather slow at first.	E.	

Jasminum sambac	Jasmine	A vigorous, evergreen shrub climber with large trusses of fragrant, white flowers.	E.
Lonicera periclymenum	Honeysuckle (Woodbine)	Hardy climber with sweet-scented yellow flowers.	E.
Podranea brycei	Zimbabwe creeper	A rank-growing indigenous creeper with large, pink flowers.	E.

Palms, Bamboos, etc.

Arundo donax	Spanish reed	A reed growing 20 feet to 25 feet in height and 1 inch thick, and very superior to the indigenous variety.	Offsets 1s. 6d each
Bambusa arundinacea	Whipstick bamboo	About 30 feet.	Offsets 2s. 6d. each
Bambusa sp.	Indian variety	Similar in growth to the Bindura, with very useful rods.	Offsets 2s. 6d. each.
Oxytenanthera abyssinica	The Bindura bamboo ...	The only variety indigenous to Rhodesia, giving very useful solid rods, very tough.	Offsets 2s. 6d. each
Phoenix reclinata	Wild date palm...	A very hardy palm, indigenous to the Colony.	—
Phormium tenax	New Zealand flax . .	A useful green foliaged plant, about 4 feet high with sword-like leaves.	E.
Washingtonia robusta	Fan palm	A strong-growing fan palm **Palms 2s. 6d. to 7s. 6d each**	—

Offsets of Bamboos supplied during rainy season only

Southern Rhodesia Veterinary Report

OCTOBER, 1948.

General. Grazing was reported to be fair in the Salisbury district, adequate in Bulawayo and Umtali and greatly improved in the districts of Gwelo, Fort Victoria and Melsetter. In the three latter districts the condition of cattle is satisfactory and fair in Salisbury.

In Bulawayo, in spite of the excellent rains, there has been a falling off of condition of cattle. It is notable that during the 1946 drought that the grass, in those places where it was plentiful, seemed to have a high feeding value.

Tick Life. Very active in all districts.

Diseases: African Coast Fever. No further cases on any of the previously infected farms.

Foot and Mouth Disease. There have been no further outbreaks and the semi-quarantine areas in Umtali, Chipinga and Melsetter districts have been removed.

Epi-Vaginitis. One outbreak was diagnosed in Bulawayo. This is the first in that district. Salisbury district seven new centres of infection were notified. Artificial insemination has been continued on one farm, 64 animals having been served to date.

Anthrax. Severe outbreak on the Chikwanda, Chibi and Victoria Reserves.

Trypanasomiasis. No cases reported.

Lumpy Skin Disease. A few mild cases occurred in the Gwelo district.

Quarter Evil. All districts reported clear except Gwelo and Fort Victoria where the incidence was very mild and in Salisbury where there were 4 outbreaks with 12 deaths.

Anaplasmosis. One death in Fort Victoria, one case confirmed in Bulawayo district and 3 in Salisbury.

Piroplasmosis. Four cases reported in Salisbury district and eight in Bulawayo. In the Umtali district eight cases were detected in imported cattle and all but one recovered after treatment.

Paratyphoid. Fort Victoria—Clipsham, all calves were inoculated.

Geilsiekte. Suspected at Turgwe river, Devuli—five deaths.

Sheath Obstruction. Numerous cases reported Ndanga and Bikita Reserves.

Horse Sickness. Two cases Fort Victoria and one case in Salisbury.

Mallein Testing. Sixty-two horses and 14 mules were tested. There were no reactors.

Tuberculin Testing. Thirty-four bulls, 20 cows, 39 heifers and 14 yearlings tested. There were no reactors.

IMPORTATIONS.

Union of South Africa: Bulls (breeding) 34, cows and calves (breeding) 59, horses and mares 25, geldings 36, mules 12.

United Kingdom: Horses and mares 1.

EXPORTATIONS.

Nyasaland: Bulls (breeding) 1.
Portuguese East Africa: Oxen (slaughter) 24.
Northern Rhodesia: Pigs (breeding) 7.
Bechuanaland Protectorate: Pigs (breeding) 1.

EXPORTATIONS—MISCELLANEOUS.

In Cold Storage.

Northern Rhodesia: Bacon 14,068 lbs., ham 15 lbs., gammon 653 lbs., offal 5,134 lbs.

Bechuanaland Protectorate: 253 lbs. bacon, 211 lbs. offal, 23 lbs. beef, 325 lbs. sausage, 138 lbs. pork.

Meat Products from Liebig's (Rhodesia) Ltd., West Nicholson.

Union of South Africa: Corned beef 96,000 lbs., Vienna sausage 39,750 lbs., potted beef 2,700 lbs.

Belgian Congo: Corned beef 10,440 lbs.

Portuguese East Africa: Corned beef 1,080 lbs., potted beef 150 lbs.

P. D. HUSTON,
Director of Veterinary Services.

NOVEMBER, 1948.

General. Good rains have fallen throughout most districts and grazing is good and plentiful and the condition of cattle greatly improved. In Bulawayo District the rainfall was not so good but earlier rains have improved the grazing in most areas. Bulawayo further reports that some herds in Wankie have not improved as they should. This is attributed to heavy infestation of worms and in this connection dosing experiments have been carried out, the result of which will be observed.

Tick Life. Very active in all areas. Cattle have wintered well and it is considered that if dipping had been adequately carried out the present position would not have arisen.

Diseases. African Coast Fever.

No new cases reported.

Foot and Mouth Diseases. The position on the Bechuanaland Border remains unchanged with no infection present. In Umtali district all infected areas still retained in quarantine, throughout which periodic inspections continue. No active cases have been reported since May, 1948.

Epi-Vaginitis. The position in the Salisbury District is that inspection has revealed further infection. The disease was diagnosed on three further farms in the Bulawayo district.

Anthrax. Two deaths confirmed and four reported in Salisbury district.

Heartwater. Fairly heavy mortality in Bulawayo district and several deaths at Fort Victoria, where mortality continues.

Trypanosomiasis. No cases reported.

Anaplasmosis. Eight deaths in Salisbury area and sporadic cases reported in several areas near Umtali.

Piroplasmosis. Nine deaths in Salisbury and one case confirmed at Lakeside, Bulawayo.

Lumpy Skin Disease. A few mild cases in Que Que area.

Quarter Evil. Three outbreaks in Salisbury district, which resulted in 17 deaths with several cases confirmed in Bulawayo district.

Contagious Abortion. Samples taken on farms in Fort Victoria area revealed higher percentage of infection.

Paratyphoid. Two cases reported in Fort Victoria District.

Geilsiekte. No reports.

Sheath obstruction. Was reported on farms in Fort Victoria area.

Horse Sickness. No reports.

Biliary Fever. In horses occurred in Umtali, Umtali South and at Headlands.

Opthalmia and Screw Worm. Was prevalent throughout the Gwelo district and is on the increase in the Melsetter district.

Vegetable Poisoning. Three deaths in Salisbury district; further cases were reported in the Fort Victoria area. Some cases of digestive trouble were reported in the Gwelo District which may have been due to plant poisoning.

Arsenical Poisoning. 21 deaths in Salisbury district and 14 at Chipinga; further cases are suspected on the Ndanga Reserve. Arsenical Poisoning was also responsible for the death of seven Friesland heifers at Inyazura.

Mallein Testing. 32 horses and 12 mules were tested. There were no reactors.

Tuberculin Testing. 22 bulls, 38 cows, 11 heifers and 1 yearling were tested. There were no reactors.

IMPORTATIONS.

Union of South Africa: Horses and mares 6, geldings 30, mules 26, bulls (breeding) 23, cows and calves (breeding) 64.

EXPORTATIONS.

Portuguese East Africa: Pigs (breeding) 7, oxen (slaughter) 19, bulls (slaughter) 1, cows (slaughter) 2.

Northern Rhodesia: Pigs (breeding) 4.

Union of South Africa: Pigs (breeding) 1.

EXPORTATIONS—MISCELLANEOUS.

In Cold Storage.

Northern Rhodesia: Bacon 17,133 lbs., gammon 2,076 lbs., ham 186 lbs., offal 5,401 lbs.

Bechuanaland Protectorate: Bacon 187 lbs., beef 13 lbs., sausage 256 lbs., brawn 18 lbs., pork 92 lbs., dripping 315 lbs.

Meat Products from Liebig's (Rhodesia) Ltd., West Nicholson.

Union of South Africa: Corned beef 203,880 lbs., curried beef 2,400 lbs., Oxford sausage 12,000 lbs.

Belgian Congo: Corned beef 5,400 lbs.

P. D. HUSTON,
Director of Veterinary Services.

SOUTHERN RHODESIA
Locust Invasion, 1932-1948

MONTHLY REPORT No. 193: NOVEMBER, 1948.

Red Locusts: *Nomadacris septemfasciata Serv.*

No Red Locusts in any stage of development within the Colony were reported.

M. C. MOSSOP,
Chief Entomologist.

MONTHLY REPORT No. 194: DECEMBER, 1948.

Red Locusts: *Nomadacris septemfasciata Serv.*

No Red Locusts in any stage of development within the Colony were reported.

M. C. MOSSOP,
Chief Entomologist.

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ERRATUM

P. 238, 10th line from bottom, after "sleeping sickness" add "within the Colony."

AUTHORS INDEX